PART 650
ENGINEERING FIELD HANDBOOK

CHAPTER 2 ESTIMATING RUNOFF

Contents

Section I – General Overview of Estimating Runoff and Peak Discharges using NOAA Atlas 14 Rainfall Depth and Distribution Types

This supplement provides the most current rainfall data available, National Oceanic and Atmospheric Administration Atlas 14 (NOAA 14), and will be used for hydrologic calculations in the design of conservation practices. This supplement updates the rainfall depths and distribution types required by the EFH-2 computer program for estimating runoff and peak discharges as described in Engineering Field Handbook (EFH) Part 650, Chapter 2 (EFH-2). The rainfall depths and distribution types will also be used in all applicable computer programs such as WinTR-55, WinPond, etc. In addition, statewide GIS shapefile and KMZ file of the county/rainfall zones and rainfall distribution types have been developed for easy access of NOAA 14 data.

This supplement describes the technical background, implementation process, and provides an example application of the rainfall depths and distribution types used in the EFH-2 computer program.

Section II – Technical Background

NOAA completed Volumes 8 and 9 of NOAA 14 precipitation-frequency analysis for the Midwest and Southeast United States in 2013. Specifically of interest for Florida is the NOAA 14 Volume 9 which contains precipitation frequency estimates for the six southeastern states of Alabama, Arkansas, Florida, Georgia, Louisiana, and Mississippi. This is the first comprehensive precipitation-frequency analysis for the southeast since TP-40 was completed in 1961. NOAA used periods of record for rainfall stations up through December 2012 to compute precipitation-duration-frequency values. The period of record for TP-40 ended in 1958. This additional 54 years of data provides different frequency-duration rainfall values than TP-40.

(a) Rainfall Distribution Types

Extents of Rainfall Distribution Types

With the release of Volumes 8 and 9 of NOAA 14, six new rainfall distributions (MSE 1-6) were developed by NRCS for the Midwest and Southeast areas of the United States to replace the Type II and Type III and respective EFH-2 coefficients for each rainfall distribution types. Types MSE 4, MSE 5, and MSE 6 are the three, new rainfall distribution types that are applicable to Florida. One set of three new rainfall distribution types (MSE 4, MSE 5 and MSE 6) was developed for the standard SCS unit hydrograph (dimensionless unit hydrograph peak factor of 484). A second set of three new rainfall distribution types (MSE 4, MSE5, and MSE 6) was developed for the DelMarVa unit hydrograph (dimensionless unit hydrograph peak factor of 284). The DelMarVa (DMV) unit hydrograph may be used in areas with average watershed slopes of 0.5 percent or less without benches or terraces.

The extent of each rainfall distribution region was based on the 60-minute/24-hour ratio of the 25-year NOAA 14 data. The thresholds for the 6 regions are as follows.

1 > 0.58
2 0.53 to 0.58
3 0.48 to 0.53
4 0.43 to 0.48
5 0.38 to 0.43
6 < 0.38

For reference, the 60-minute to 24-hour ratio for the Type II rainfall distribution is 0.45 and the ratio for the Type III is 0.40. Based on the NOAA Atlas 14 data, rainfall distributions less intense, of similar intensity, and more intense than the Types II and III have been developed

Peak Equation Coefficients

Rainfall distributions were created for each region and used in WinTR-20 models to

develop peak flow equation coefficients for use in the EFH-2 computer program. To simplify the estimation of peak discharge, WinTR-20 was run with times of concentration of 0.1 to 10.0 hours and I_a/P ratios of 0.1, 0.25, 0.3, 0.4 and 0.5. I_a is initial abstraction in units of inches. Initial abstraction includes all losses before runoff begins (interception, depression storage, early storm infiltration, etc.). P is the storm rainfall with units of inches and
CN = NRCS runoff curve number.

$$I_a = 0.2 * ((1000 / CN) - 10)$$

(Equation 1)

Equations to relate time of concentration to unit peak discharge were then developed. The equation used to compute the unit peak discharge (q) for the EFH-2 computer program is:

$$q = 10^{(Coeff\_1 + Coeff\_2*LOG(Tc) + Coeff\_3*(LOG(Tc))^2)}$$

(Equation 2)

The coefficients to be used with each rainfall distribution are tabulated below. For example, the equation applicable to the MSE 4 (Standard UH) rainfall distribution region of Florida and I_a/P ratio of 0.1 is:

$$q = 10^{(2.5447 - 0.6222 * LOG(Tc) - 0.1332 * (LOG(Tc))2)}$$

(Equation 3)

For a time of concentration of 0.5 hours and Ia/P ratio of 0.1, the unit peak discharge is q = 524.72 cfs/inch/sq. mile. If the drainage area is 200 acres (0.31 square miles) and there is 1.5 inches of runoff, the peak discharge, Q, is:

$$Q = 524.72 * 0.31 * 1.5 = 244 \text{ cfs}$$

(Equation 4)

The EFH-2 computer program is unable to use site specific rainfall types. Instead, EFH-2 uses equations to produce the unit peak discharge (cubic feet per second per inch of runoff per square mile of drainage area) from the time of concentration and excess runoff volume. The coefficients for these equations were developed for the three new rainfall types (MSE 4, MSE 5 and MSE 6) from the NOAA 14 data. The equations coefficients and plots for the three NOAA 14 rainfall distribution types are included in the **type.rf** file. The equations plots and coefficients for the three NOAA 14 rainfall distribution types are shown in Figures 1 - 7 and Tables 1 - 6 respectively.

Figure 7 plots are for use with 24-hour design storms. They represent the accumulated rainfall during the 24-hour storm duration on a non-dimensional basis. The maximum accumulated rainfall in the plot is 1.0 which represents the total storm 24-hour rainfall.

These new rainfall types replace the NRCS Type II and III in EFH-2 for Florida. The Type II and III should no longer be used unless an old model needs to be recreated. Figure 8 graphically displays appropriate rainfall distribution types to use per county and rainfall zone. The rainfall distribution type for each county is also presented in Table 7. The rainfall distribution type (**type.rf**) is developed for use with the EFH-2. The type.rf file is only used in EFH-2. There is also a statewide GIS shapefile and KMZ file of the county/rainfall zones and distribution types available for use in ArcGIS® and Google Earth® to determine the rainfall distribution type. The rainfall database (**COUNTY.FL**), rainfall distribution types (**type.rf)**, and GIS shapefile and KMZ file of the county/rainfall zones and rainfall distribution types are included in two zipped files titled "NOAA_14_FL_GIS" and "NOAA_14_FL_Documentation." The zipped files are located on the NRCS webpage titled H & H Tools and Models at the following link: http://go.usa.gov/KoZ. Then click on WinTR-20 to go to Win TR-20 Watershed Hydrology web page. Then go to WinTR-20 Support Materials, NOAA 14 Data, and click on links for FL.

Rainfall Depth

Representative county values for the 24-hour rainfall depths are presented in Table 7. The rainfall depths are incorporated into the rainfall database for use with the EFH-2 computer program (**COUNTY.FL**).

The representative county rainfall values were determined from the NOAA 14 GIS grid. The location of the representative county value is near the mean of the 100-year 24-hour rainfall for the county or rainfall zone (explained below). If a more precise rainfall estimate is desired, site specific data may be downloaded from the NOAA 14 website. Data are available for specific locations from the interactive web site (http://hdsc.nws.noaa.gov/hdsc/pfds/ .

(b) Rainfall Zones

Rainfall in NOAA Atlas 14 can be highly variable even on a county basis, particularly in the areas along the coastline of Florida. For example, the Palm Beach County 100-year 24-hour storm ranges from 10.5 inches to 16.3 inches. When the 100-year 24 hour rainfalls range is greater than 1.5 inches within a county, the county was split into rainfall zones. Forty-seven counties are split into zones where two or more rainfall values are designated for a total of 128 new county/rainfall zones. Figure 9 graphically shows the counties that were split into multiple rainfall zones. Data from Lake Okeechobee was excluded from the analysis. The rainfall zones are shown in Table 7.

There are three sources to determine the county/rainfall zone of interest.

(1) Figures 10 - 14 of this contains maps that designate the boundaries of the county/rainfall zones. The maps in this supplement are difficult to read and it is recommended that the maps be downloaded and printed to a scale that can be easily read;

(2) There is also a GIS shapefile available for use in ArcGIS®, and

(3) A KMZ file has been prepared so that Google Earth® can be used to determine the county/rainfall zones for a specific point.

The county/rainfall zone maps, GIS shapefile and KMZ are included in two zipped files titled "NOAA_14_FL_Documentation" and "NOAA_14_FL_GIS". The zipped files are located on the NRCS webpage titled H & H Tools and Models at the following link: http://go.usa.gov/KoZ. Then click on WinTR-20 to go to Win TR-20 Watershed Hydrology web page. Then go to WinTR-20 Support Materials, NOAA 14 Data, and click on links for FL.

Figure 1 – EFH-2 Peak Discharge Curves for MSE 4

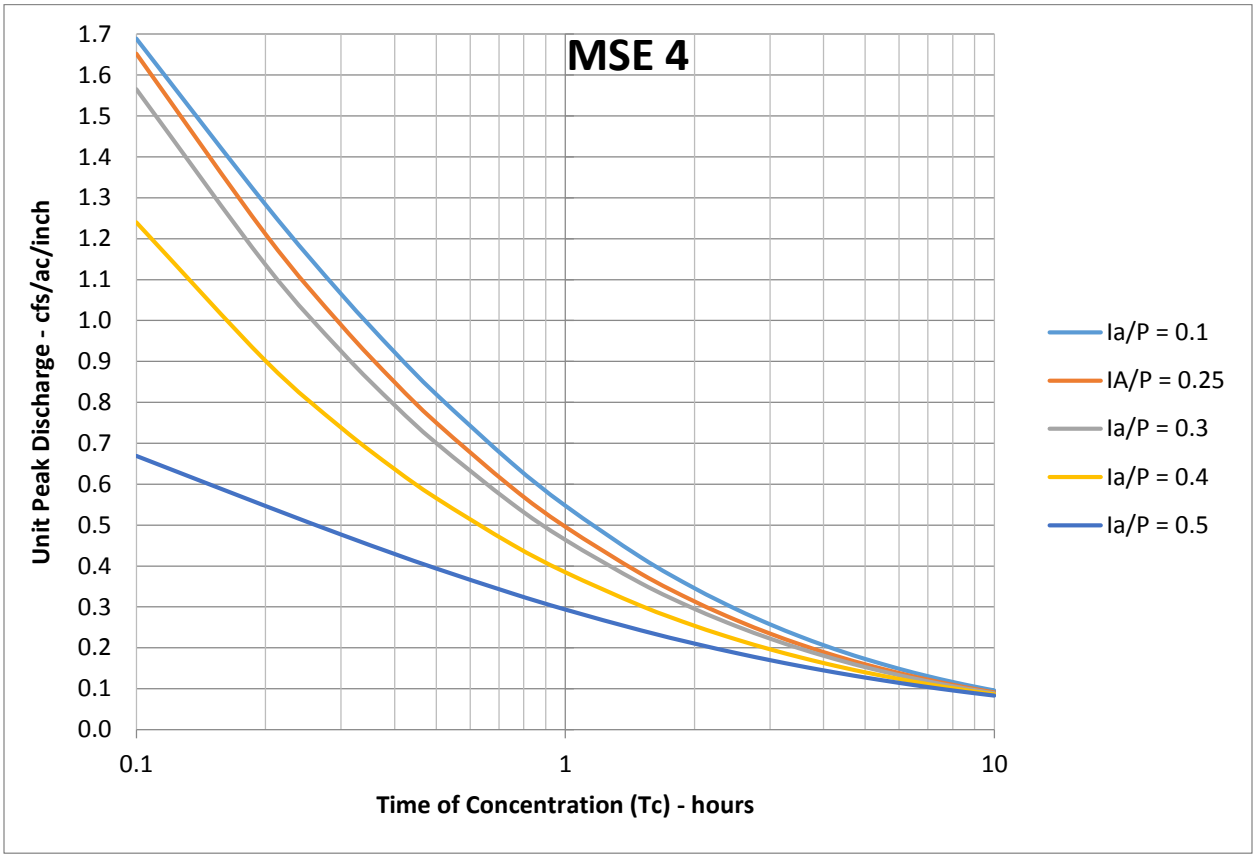


Table 1 – EFH-2 Peak Discharge Equation Coefficients for MSE 4

I_a/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.5447	-0.6222	-0.1332
0.25	2.5016	-0.6298	-0.1071
.3	2.473	-0.6226	-0.0947
0.4	2.3917	-0.5773	-0.0694
0.5	2.2743	-0.4524	-0.0948

Figure 2 – EFH-2 Peak Discharge Curves for MSE 5

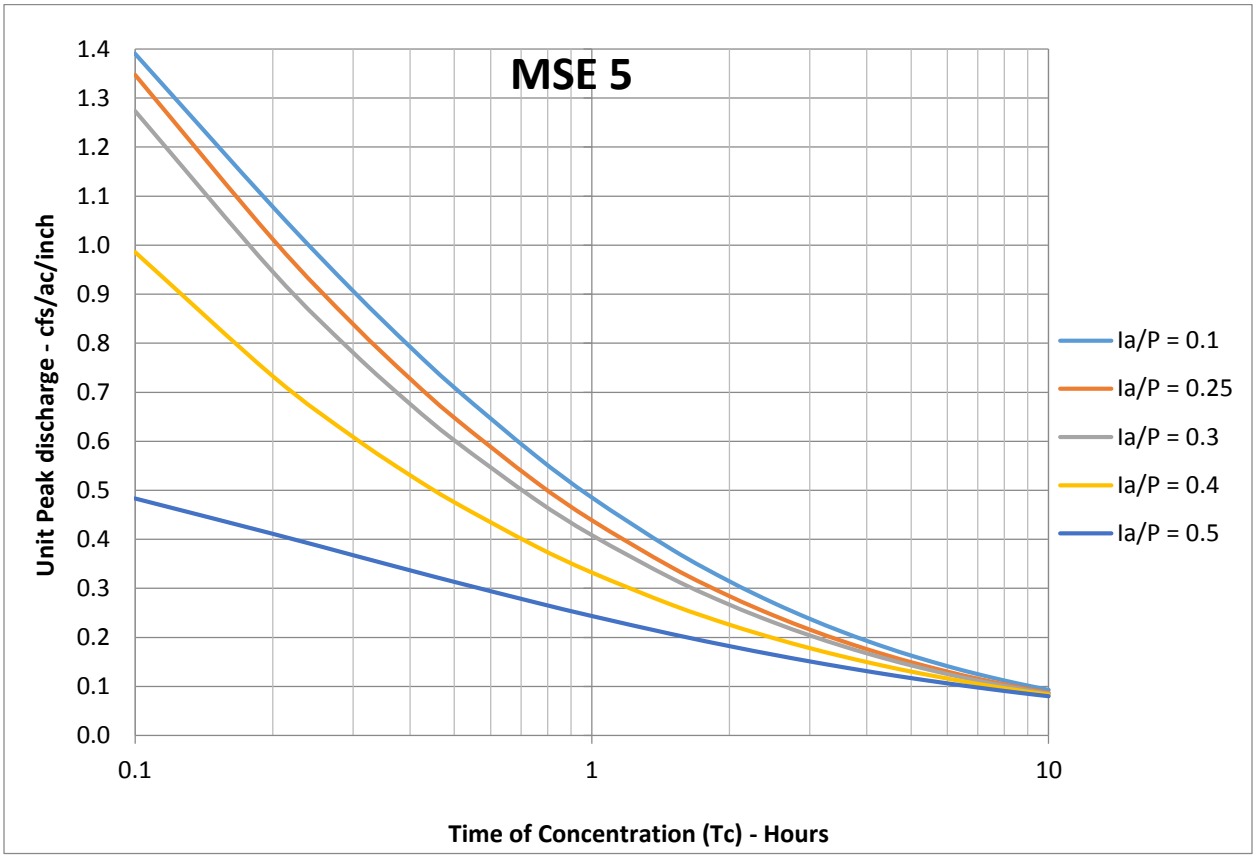


Table 2 – EFH-2 Peak Discharge Equation Coefficients for MSE 5

I_a/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.4922	-0.5871	-0.13
0.25	2.4485	-0.5944	-0.1073
.3	2.4176	-0.5866	-0.093
0.4	2.3275	-0.5372	-0.0647
0.5	2.1929	-0.3911	-0.0933

Figure 3 – EFH-2 Peak Discharge Curves for MSE 6

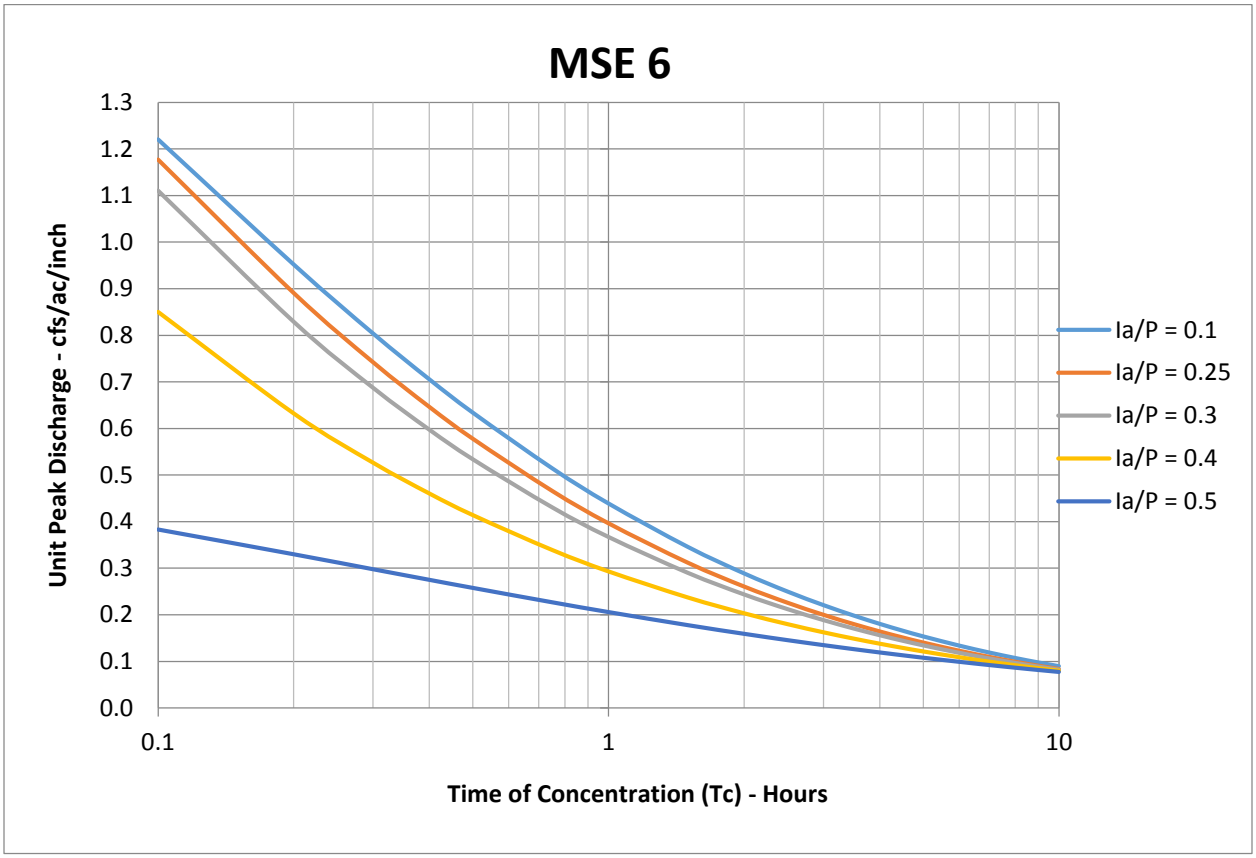


Table 3 – EFH-2 Peak Discharge Equation Coefficients for MSE 6

I_a/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.4487	-0.5669	-0.1228
0.25	2.4045	-0.5735	-0.1011
.3	2.371	-0.5655	-0.0847
0.4	2.2723	-0.5137	-0.0509
0.5	2.1193	-0.3481	-0.078

Figure 4 – EFH-2 Peak Discharge Curves for MSE 4 DMV

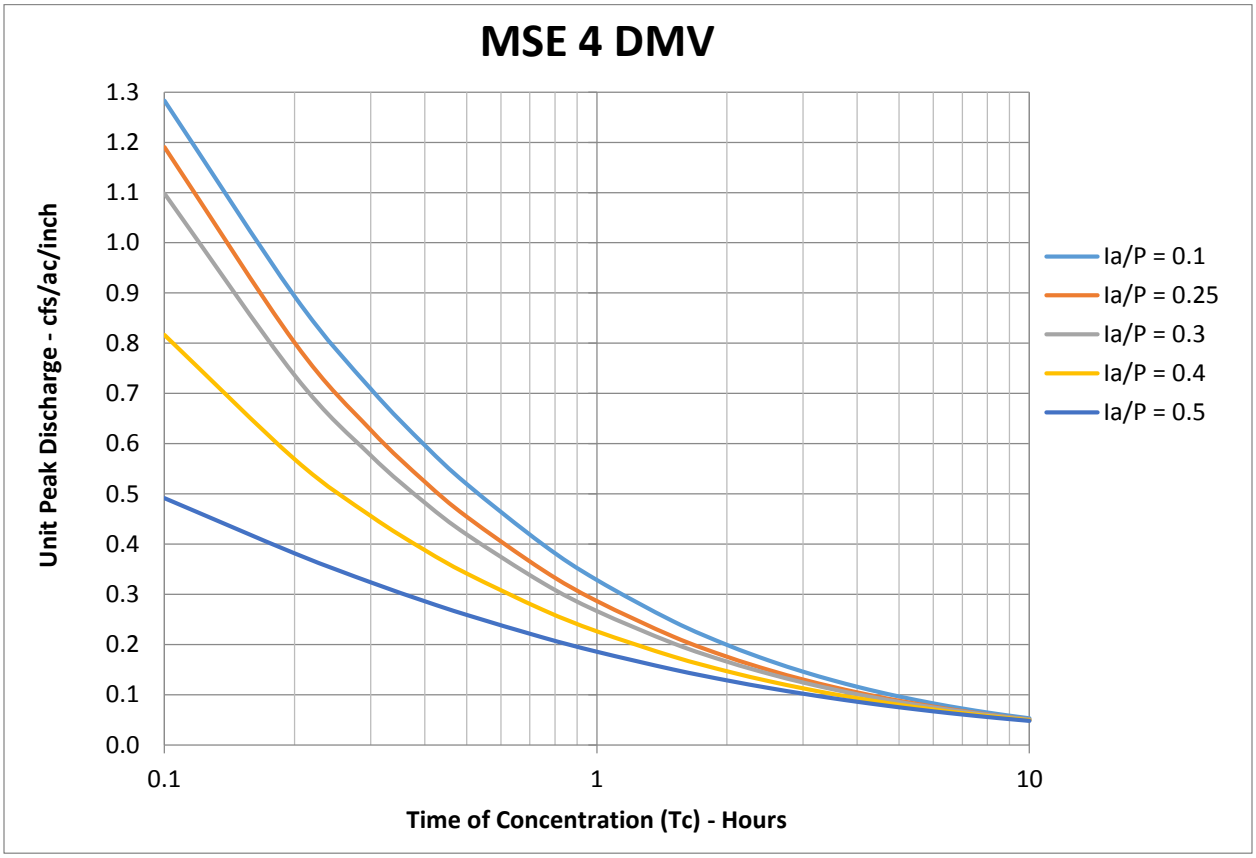


Table 4 – EFH-2 Peak Discharge Equation Coefficients for MSE 4 DMV

I_a/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.3226	-0.6912	-0.0995
0.25	2.2634	-0.6853	-0.0669
.3	2.2319	-0.6691	-0.0541
0.4	2.161	-0.6085	-0.0515
0.5	2.0749	-0.5054	-0.0824

Figure 5 – EFH-2 Peak Discharge Curves for MSE 5 DMV

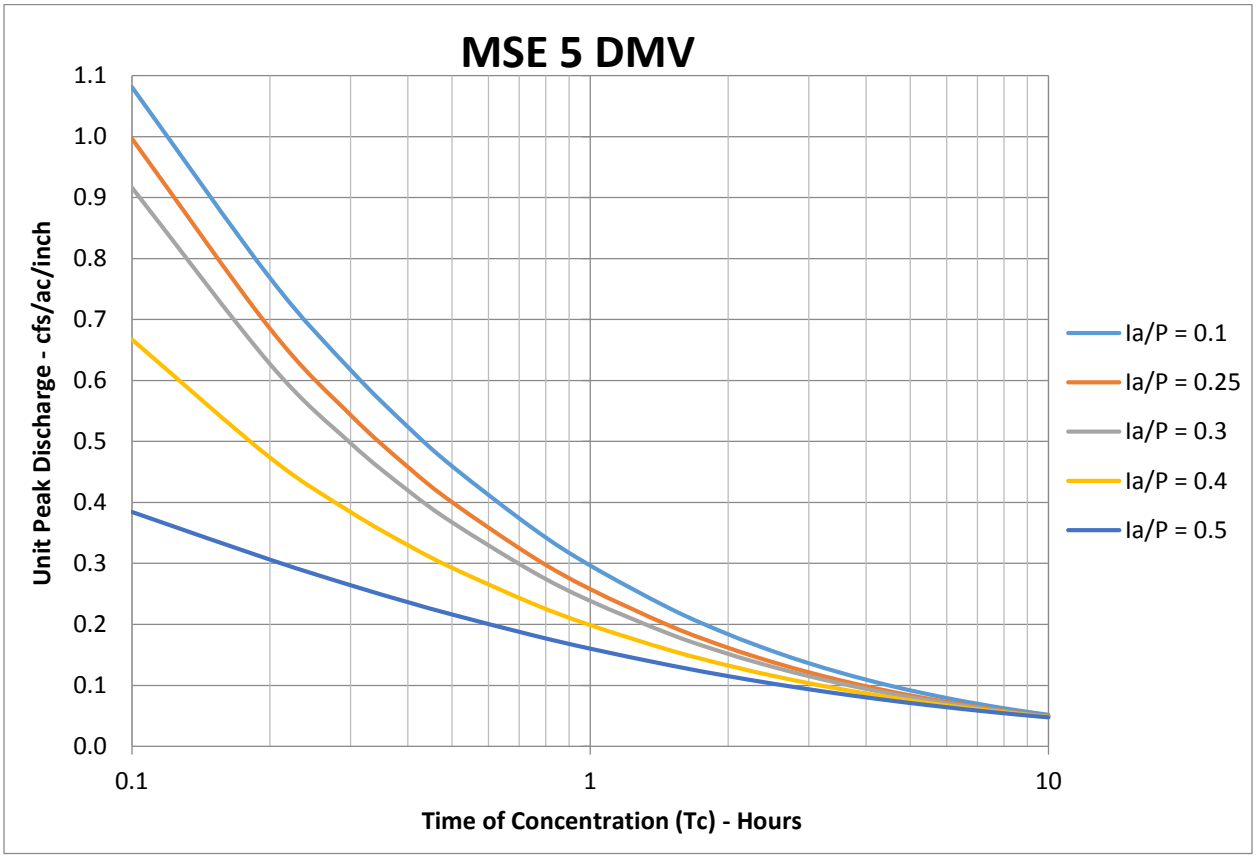


Table 5 – EFH-2 Peak Discharge Equation Coefficients for MSE 5 DMV

Ia/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.2783	-0.6609	-0.099
0.25	2.2176	-.6543	-0.0671
0.3	2.1839	-0.6384	-0.0538
0.4	2.1047	-0.5717	-0.0457
0.5	2.011	-0.4545	-0.0743

Figure 6 – EFH-2 Peak Discharge Curves for MSE 6 DMV

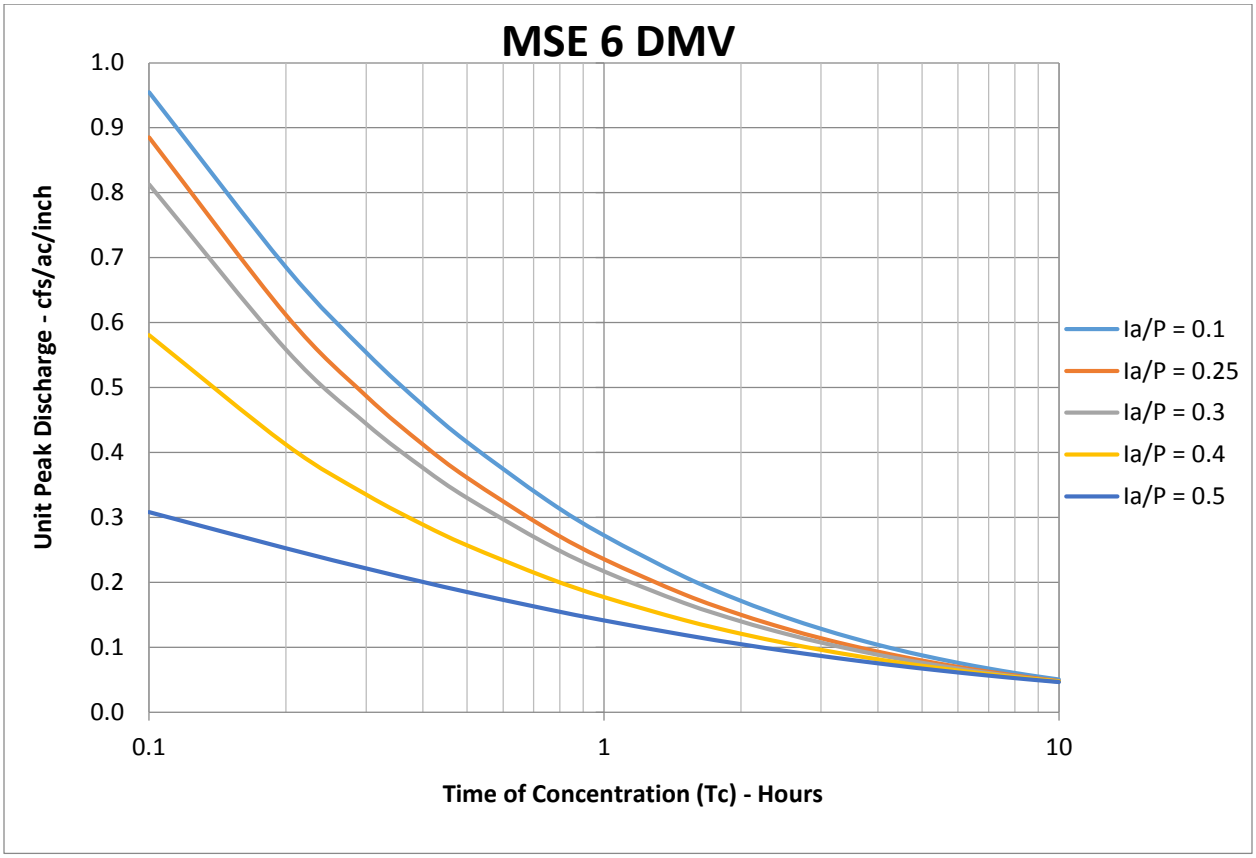


Table 6 – EFH-2 Peak Discharge Equation Coefficients for MSE 6 DMV

I_a/P	Coeff_1	Coeff_2	Coeff_3
0.1	2.241	-0.64	-0.0949
0.25	2.178	-0.6346	-0.0594
.3	2.1425	-0.619	-0.0454
0.4	2.0544	-0.5452	-0.0294
0.5	1.9566	-0.4108	-0.0723

Figure 7 – Plots of the Midwest/Southeast Region Rainfall Distributions.

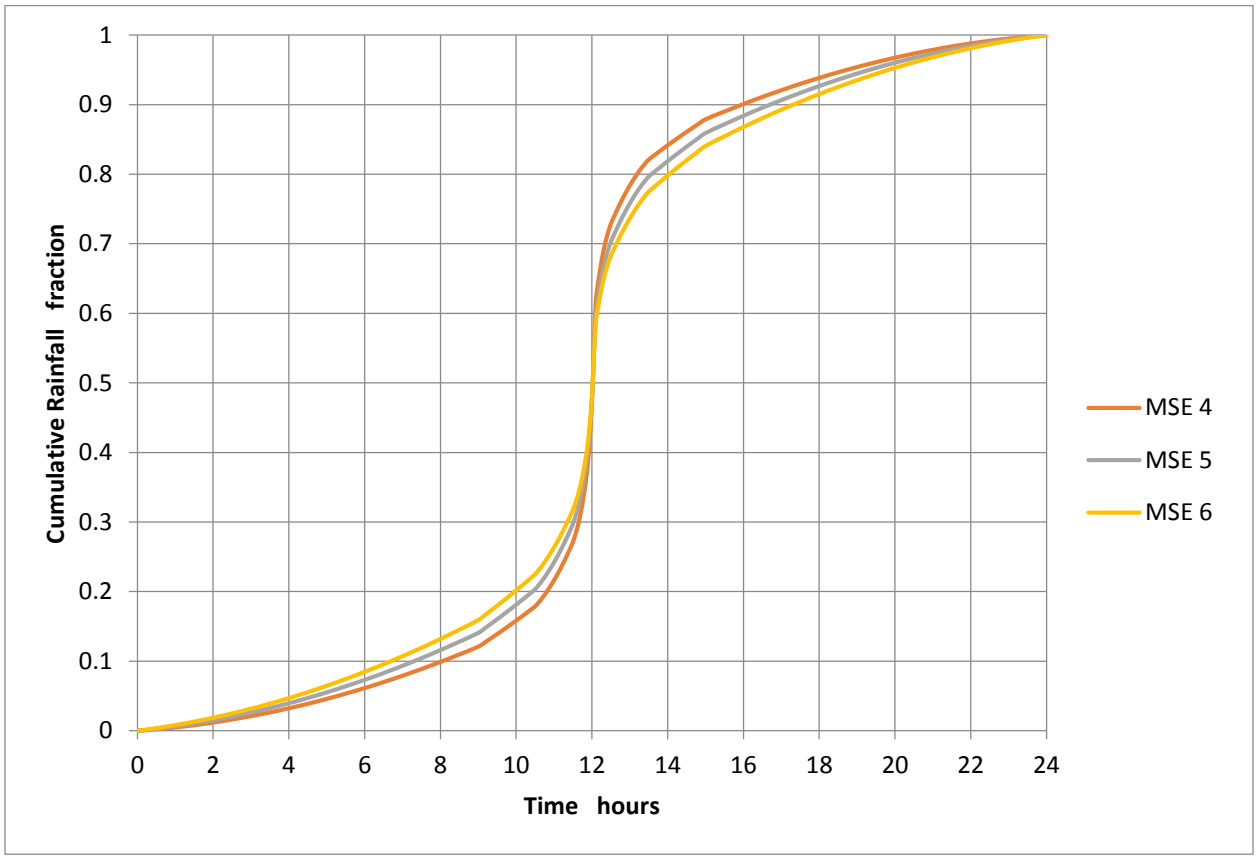


Figure 8 – EFH-2 Rainfall Distribution Types for Florida

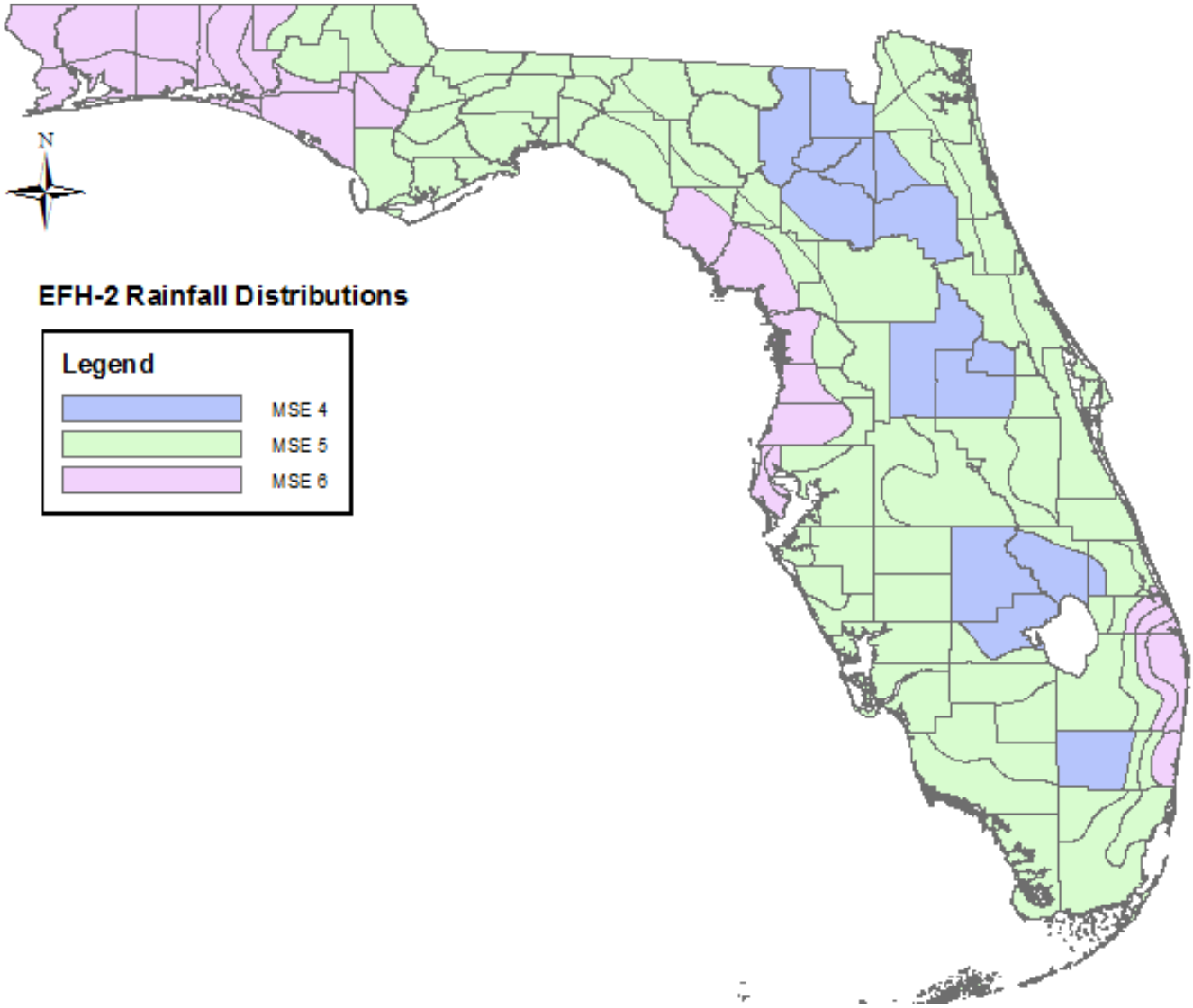


Figure 9 – EFH-2 Rainfall Zones for Florida

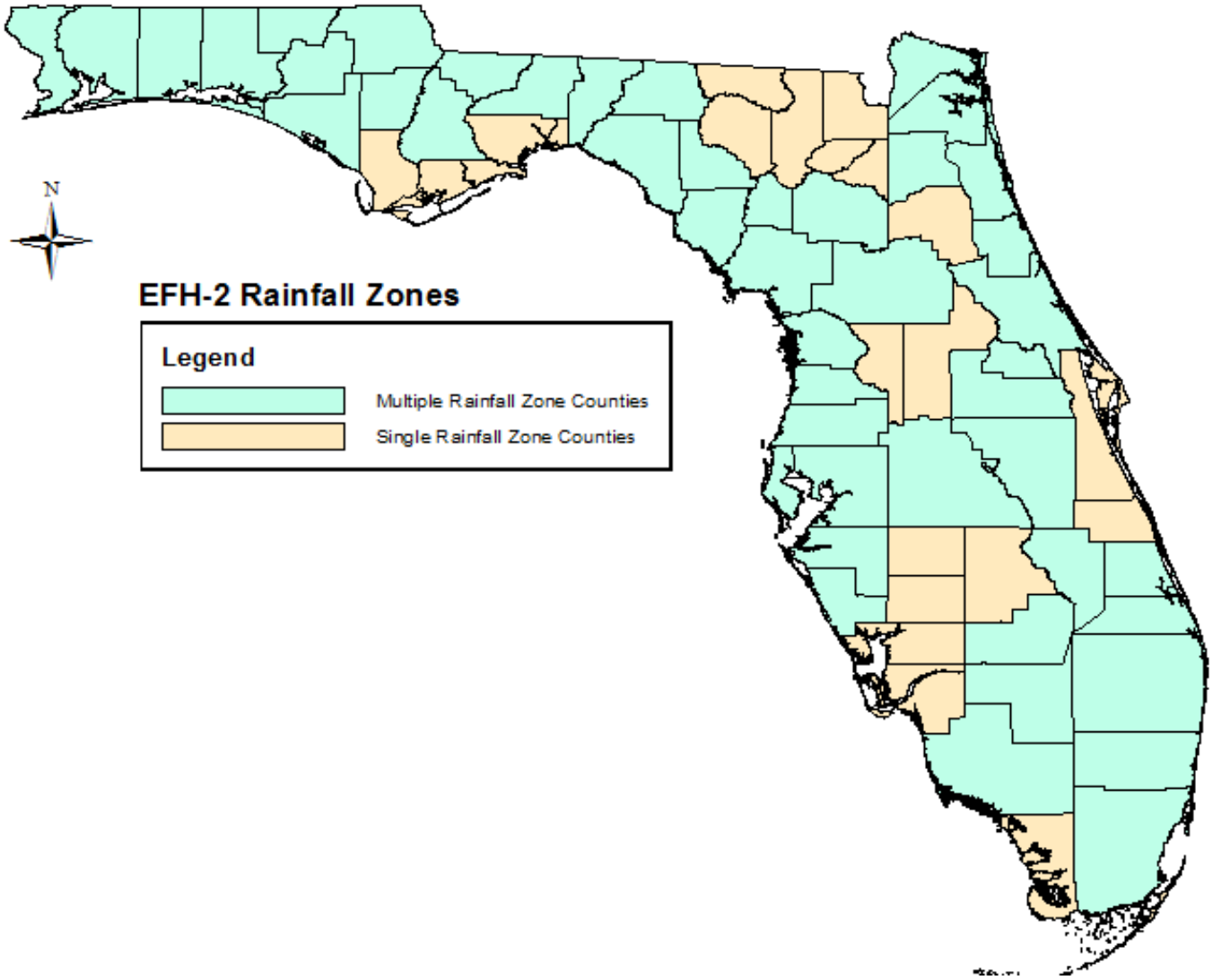


Table 7 – 24-Hour Rainfall Values and Distribution Types for Each County and Rainfall Zone

County/Rainfall Zone	Rainfall Type	1-year (in)	2-year (in)	5-year (in)	10-year (in)	25-year (in)	50-year (in)	100-year (in)
ALACHUA EAST	MSE 4	3.74	4.2	5.08	5.95	7.35	8.58	9.95
ALACHUA WEST	MSE 5	3.93	4.41	5.38	6.35	7.92	9.32	10.88
BAKER	MSE 4	3.82	4.36	5.33	6.23	7.6	8.76	10.01
BAY NORTH	MSE 6	4.44	5.16	6.48	7.7	9.57	11.17	12.9
BAY SOUTH	MSE 6	4.53	5.36	6.84	8.17	10.18	11.86	13.65
BRADFORD	MSE 4	3.71	4.16	5.02	5.85	7.17	8.33	9.6
BREVARD	MSE 5	3.95	4.68	6.04	7.31	9.27	10.96	12.8
BROWARD EAST 1	MSE 6	4.67	5.63	7.39	9.03	11.54	13.69	16.01
BROWARD EAST 2	MSE 5	4.47	5.29	6.82	8.28	10.56	12.55	14.72
BROWARD WEST 1	MSE 4	3.91	4.45	5.52	6.59	8.32	9.87	11.59
BROWARD WEST 2	MSE 5	4.13	4.85	6.21	7.5	9.53	11.29	13.23
CALHOUN NORTH	MSE 6	4.22	4.89	6.12	7.26	9	10.48	12.09
CALHOUN SOUTH	MSE 6	4.5	5.24	6.57	7.81	9.71	11.34	13.09
CHARLOTTE	MSE 5	3.8	4.46	5.62	6.67	8.24	9.55	10.94
CITRUS EAST	MSE 5	3.95	4.42	5.42	6.46	8.2	9.8	11.6
CITRUS WEST	MSE 6	4.2	4.82	6.04	7.26	9.23	10.99	12.95
CLAY EAST	MSE 5	3.89	4.45	5.49	6.47	8.02	9.35	10.81
CLAY WEST	MSE 4	3.81	4.3	5.24	6.12	7.5	8.7	10.01
COLLIER NORTH	MSE 5	3.83	4.56	5.83	6.97	8.66	10.07	11.56
COLLIER SOUTH	MSE 5	3.95	4.75	6.14	7.38	9.21	10.71	12.3
COLUMBIA	MSE 4	3.75	4.24	5.17	6.04	7.4	8.56	9.84
DE SOTO	MSE 5	3.65	4.19	5.2	6.15	7.63	8.9	10.29
DIXIE NORTH	MSE 5	4.25	4.87	6.07	7.22	9.03	10.62	12.37
DIXIE SOUTH	MSE 6	4.55	5.19	6.46	7.71	9.73	11.52	13.52
DUVAL EAST	MSE 5	4.06	4.69	5.88	7.03	8.82	10.38	12.09
DUVAL WEST	MSE 5	3.92	4.49	5.56	6.58	8.16	9.54	11.04
ESCAMBIA NORTH	MSE 6	4.86	5.6	7.06	8.5	10.84	12.92	15.23
ESCAMBIA SOUTH	MSE 6	5.11	5.92	7.51	9.08	11.6	13.83	16.31
FLAGLER EAST	MSE 5	3.85	4.47	5.66	6.82	8.64	10.24	12.01
FLAGLER WEST	MSE 5	3.86	4.42	5.5	6.54	8.18	9.61	11.18
FRANKLIN	MSE 5	4.67	5.45	6.87	8.19	10.19	11.9	13.74
GADSDEN NORTH	MSE 5	3.98	4.64	5.85	6.95	8.62	10.04	11.55
GADSDEN SOUTH	MSE 5	4.09	4.78	6.04	7.21	9	10.53	12.18
GILCHRIST NORTH	MSE 5	3.93	4.46	5.49	6.48	8.07	9.46	11
GILCHRIST SOUTH	MSE 5	4.19	4.77	5.9	7.01	8.79	10.37	12.12
GLADES NORTH	MSE 4	3.47	4.02	5	5.89	7.22	8.34	9.53

Table 7 – 24-Hour Rainfall Values and Distribution Types for Each County and Rainfall Zone

County/Rainfall Zone	Rainfall Type	1-year (in)	2-year (in)	5-year (in)	10-year (in)	25-year (in)	50-year (in)	100-year (in)
GLADES SOUTH	MSE 5	3.72	4.32	5.38	6.34	7.77	8.96	10.23
GULF	MSE 5	4.7	5.44	6.82	8.1	10.08	11.77	13.61
HAMILTON	MSE 5	3.8	4.38	5.41	6.32	7.66	8.77	9.94
HARDEE	MSE 5	3.71	4.29	5.34	6.32	7.81	9.08	10.46
HENDRY NORTH	MSE 5	3.62	4.25	5.37	6.39	7.92	9.21	10.58
HENDRY SOUTH	MSE 5	3.73	4.38	5.56	6.63	8.27	9.65	11.13
HERNANDO EAST	MSE 5	3.93	4.43	5.47	6.53	8.29	9.88	11.68
HERNANDO WEST	MSE 6	4.03	4.62	5.82	7.03	9.02	10.81	12.83
HIGHLANDS	MSE 4	3.53	4.06	5	5.88	7.2	8.32	9.53
HILLSBOROUGH E-Central	MSE 5	3.98	4.43	5.37	6.35	7.98	9.47	11.15
HILLSBOROUGH NW-SW	MSE 5	4.06	4.55	5.6	6.69	8.54	10.23	12.15
HOLMES EAST	MSE 5	4.23	4.83	6.01	7.17	9.04	10.7	12.54
HOLMES WEST	MSE 6	4.38	5.02	6.29	7.54	9.56	11.36	13.37
INDIAN RIVER	MSE 5	3.94	4.68	5.99	7.17	8.96	10.45	12.04
JACKSON EAST	MSE 5	3.87	4.46	5.56	6.61	8.25	9.67	11.23
JACKSON WEST	MSE 5	4.05	4.66	5.82	6.93	8.68	10.2	11.87
JEFFERSON CENTRAL	MSE 5	4.09	4.84	6.17	7.37	9.19	10.71	12.33
JEFFERSON NORTH	MSE 5	3.95	4.67	5.92	7.03	8.65	9.99	11.39
JEFFERSON SOUTH	MSE 5	4.3	5.01	6.33	7.59	9.55	11.26	13.13
LAFAYETTE NORTH	MSE 5	4.06	4.69	5.84	6.91	8.55	9.96	11.49
LAFAYETTE SOUTH	MSE 5	4.28	4.91	6.11	7.26	9.09	10.69	12.45
LAKE	MSE 4	3.75	4.2	5.13	6.07	7.61	8.99	10.55
LEE	MSE 5	3.93	4.66	5.95	7.1	8.8	10.21	11.71
LEON NORTH	MSE 5	3.89	4.56	5.78	6.91	8.61	10.06	11.61
LEON SOUTH	MSE 5	4.2	4.88	6.16	7.37	9.26	10.89	12.67
LEVY CENTRAL	MSE 5	4.21	4.78	5.89	7.01	8.82	10.44	12.25
LEVY EAST	MSE 5	3.98	4.51	5.55	6.58	8.23	9.69	11.31
LEVY WEST	MSE 6	4.41	4.96	6.13	7.35	9.39	11.26	13.38
LIBERTY CENTRAL	MSE 5	4.37	5.12	6.49	7.75	9.66	11.29	13.04
LIBERTY NORTH	MSE 5	4.07	4.77	6.03	7.2	8.97	10.47	12.08
LIBERTY SOUTH	MSE 5	4.61	5.39	6.82	8.14	10.16	11.88	13.73
MADISON NORTH	MSE 5	3.83	4.46	5.57	6.57	8.06	9.3	10.61
MADISON SOUTH	MSE 5	3.99	4.69	5.95	7.09	8.8	10.25	11.79
MANATEE EAST	MSE 5	3.98	4.53	5.59	6.62	8.27	9.71	11.31
MANATEE WEST	MSE 5	4.14	4.71	5.84	6.97	8.8	10.44	12.27

Table 7 – 24-Hour Rainfall Values and Distribution Types for Each County and Rainfall Zone

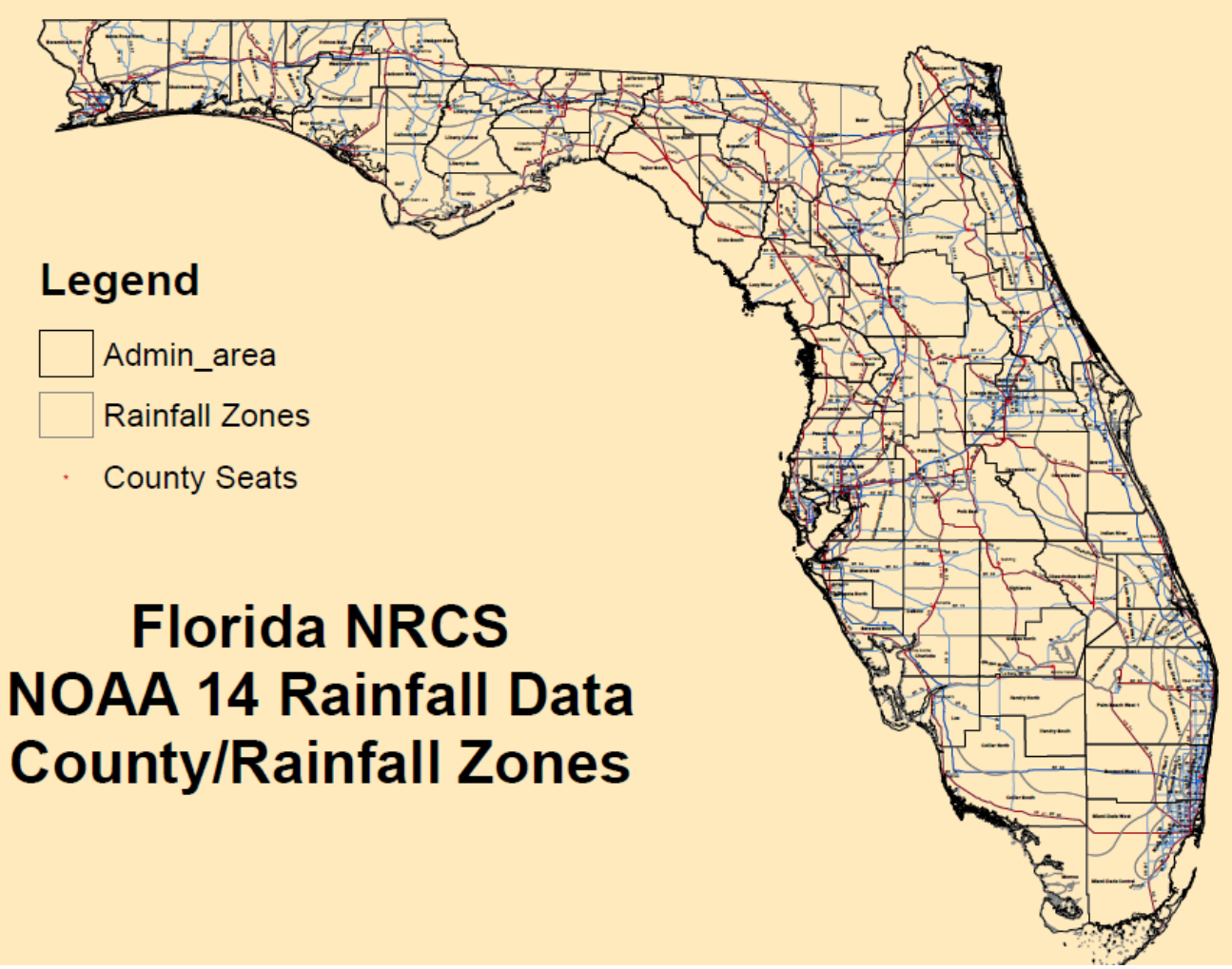
County/Rainfall Zone	Rainfall Type	1-year (in)	2-year (in)	5-year (in)	10-year (in)	25-year (in)	50-year (in)	100-year (in)
MARION EAST	MSE 5	3.79	4.28	5.25	6.22	7.81	9.22	10.8
MARION WEST	MSE 5	4.09	4.67	5.81	6.93	8.74	10.35	12.15
MARTIN CENTRAL	MSE 6	4.19	5.01	6.44	7.71	9.61	11.17	12.83
MARTIN EAST 1	MSE 6	4.59	5.55	7.27	8.84	11.21	13.21	15.34
MARTIN EAST 2	MSE 6	4.44	5.3	6.84	8.25	10.37	12.16	14.07
MARTIN WEST 1	MSE 5	3.55	4.16	5.25	6.23	7.69	8.91	10.21
MARTIN WEST 2	MSE 5	3.86	4.58	5.83	6.96	8.63	10.03	11.51
MIAMI-DADE CENTRAL	MSE 5	4.47	5.15	6.46	7.74	9.79	11.59	13.58
MIAMI-DADE EAST	MSE 5	4.58	5.39	6.91	8.35	10.59	12.53	14.65
MIAMI-DADE WEST	MSE 5	4.09	4.69	5.88	7.06	8.97	10.68	12.58
MONROE	MSE 5	4.28	4.97	6.29	7.56	9.57	11.33	13.27
NASSAU CENTRAL	MSE 5	3.94	4.59	5.79	6.92	8.7	10.22	11.89
NASSAU EAST	MSE 5	4.15	4.87	6.21	7.47	9.43	11.11	12.95
NASSAU WEST	MSE 5	3.9	4.48	5.58	6.61	8.23	9.62	11.15
OKALOOSA NORTH	MSE 6	4.71	5.53	7.09	8.61	11.02	13.13	15.47
OKALOOSA SOUTH	MSE 6	5.07	5.95	7.63	9.24	11.77	13.98	16.41
OKEECHOBEE NORTH	MSE 5	3.75	4.4	5.56	6.59	8.12	9.38	10.73
OKEECHOBEE SOUTH	MSE 4	3.49	4.06	5.07	5.98	7.33	8.46	9.66
ORANGE EAST	MSE 5	3.88	4.48	5.62	6.75	8.55	10.14	11.9
ORANGE WEST	MSE 4	3.82	4.32	5.27	6.19	7.67	8.96	10.39
OSCELOA EAST	MSE 5	3.83	4.45	5.64	6.78	8.57	10.14	11.86
OSCELOA WEST	MSE 5	3.81	4.36	5.39	6.4	8	9.41	10.96
PALM BEACH EAST 1	MSE 6	4.61	5.55	7.29	8.91	11.41	13.55	15.88
PALM BEACH EAST 2	MSE 6	4.25	5.04	6.54	7.97	10.21	12.17	14.31
PALM BEACH WEST 1	MSE 5	3.83	4.47	5.64	6.73	8.41	9.84	11.38
PALM BEACH WEST 2	MSE 5	4.02	4.72	6.03	7.28	9.22	10.89	12.73
PASCO EAST	MSE 5	3.98	4.5	5.56	6.63	8.4	9.99	11.78
PASCO WEST	MSE 6	4.08	4.64	5.81	7	8.97	10.75	12.76
PINELLAS EAST	MSE 6	4.18	4.71	5.85	7.05	9.05	10.89	12.98
PINELLAS WEST	MSE 6	4.14	4.73	5.96	7.22	9.33	11.25	13.43
POLK EAST	MSE 5	3.7	4.21	5.19	6.14	7.65	8.97	10.44
POLK WEST	MSE 5	3.78	4.24	5.19	6.16	7.74	9.17	10.78
PUTNAM	MSE 4	3.9	4.39	5.34	6.25	7.69	8.95	10.33
SANTA ROSA NORTH	MSE 6	4.91	5.66	7.14	8.61	10.99	13.11	15.47
SANTA ROSA SOUTH	MSE 6	4.99	5.86	7.51	9.12	11.67	13.9	16.37
SARASOTA NORTH	MSE 5	4.15	4.71	5.8	6.86	8.56	10.06	11.73

Table 7 – 24-Hour Rainfall Values and Distribution Types for Each County and Rainfall Zone

County/Rainfall Zone	Rainfall Type	1-year (in)	2-year (in)	5-year (in)	10-year (in)	25-year (in)	50-year (in)	100-year (in)
SARASOTA SOUTH	MSE 5	4	4.58	5.66	6.7	8.32	9.73	11.27
SEMINOLE EAST	MSE 5	3.81	4.41	5.57	6.68	8.45	10	11.71
SEMINOLE WEST	MSE 4	3.79	4.28	5.25	6.21	7.74	9.1	10.61
ST. JOHNS EAST	MSE 5	3.91	4.54	5.74	6.89	8.7	10.27	12
ST. JOHNS WEST	MSE 5	3.86	4.44	5.54	6.58	8.22	9.65	11.21
ST. LUCIE CENTRAL	MSE 5	3.79	4.49	5.7	6.79	8.4	9.73	11.14
ST. LUCIE EAST	MSE 5	3.88	4.62	5.94	7.13	8.92	10.41	12
ST. LUCIE WEST	MSE 4	3.53	4.13	5.2	6.15	7.58	8.77	10.03
SUMTER	MSE 5	3.8	4.23	5.15	6.11	7.72	9.19	10.87
SUWANNEE	MSE 5	3.88	4.48	5.56	6.55	8.04	9.3	10.65
TAYLOR NORTH	MSE 5	4.11	4.79	6.03	7.19	8.97	10.49	12.14
TAYLOR SOUTH	MSE 5	4.38	5.06	6.37	7.64	9.65	11.41	13.35
UNION	MSE 4	3.74	4.23	5.14	6	7.34	8.49	9.74
VOLUSIA EAST	MSE 5	3.92	4.62	5.92	7.15	9.06	10.71	12.51
VOLUSIA WEST	MSE 5	3.92	4.45	5.49	6.52	8.18	9.64	11.27
WAKULLA	MSE 5	4.5	5.25	6.66	7.99	10.06	11.86	13.82
WALTON CENTRAL	MSE 6	4.67	5.4	6.79	8.14	10.29	12.19	14.28
WALTON EAST	MSE 6	4.6	5.29	6.59	7.84	9.84	11.57	13.49
WALTON WEST	MSE 6	4.88	5.68	7.19	8.64	10.95	12.96	15.18
WASHINGTON NORTH	MSE 5	4.33	4.98	6.21	7.37	9.19	10.76	12.48
WASHINGTON SOUTH	MSE 6	4.51	5.25	6.6	7.86	9.8	11.46	13.26

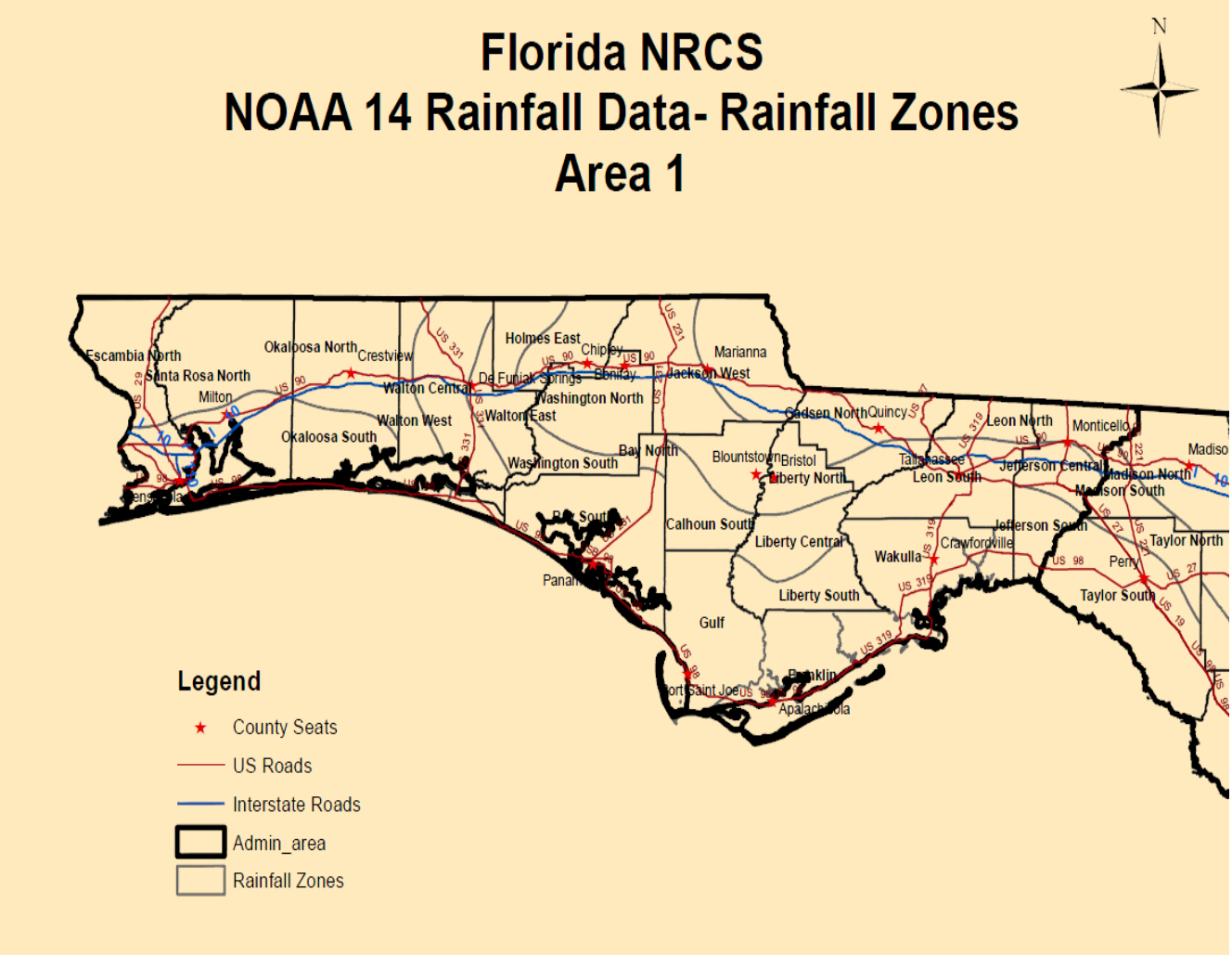
Notes: Rainfall distribution type for each county and rainfall zone is shown with the county name (MSE 4, MSE 5, and MSE 6). The 24-hour rainfall depth values are in units of inches

Figure 10 – Florida Rainfall Zones



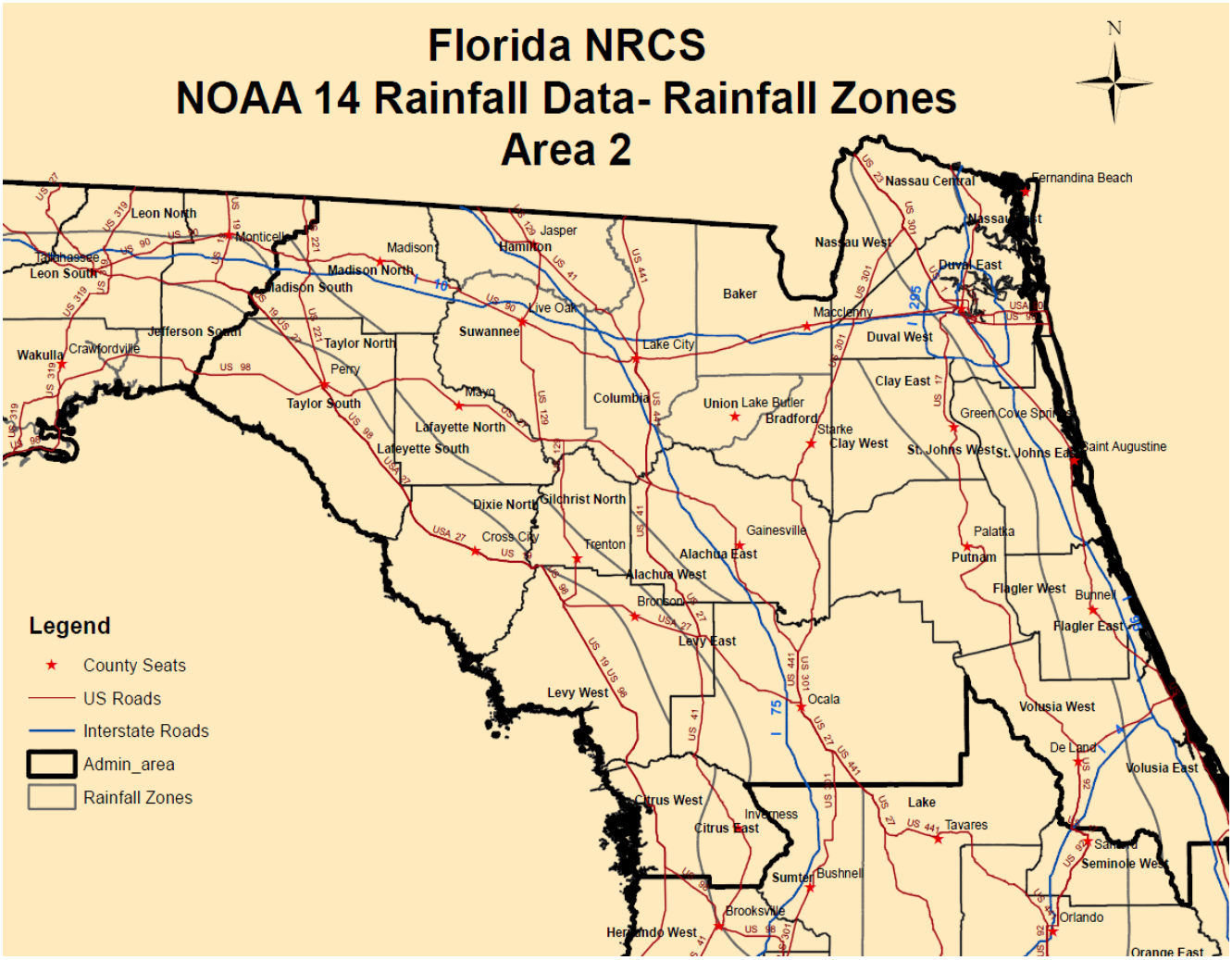
Note: This map is difficult to read. It is recommended to download the map and print to a scale that can be easily read.

Figure 11 – Florida Rainfall Zone, Area 1



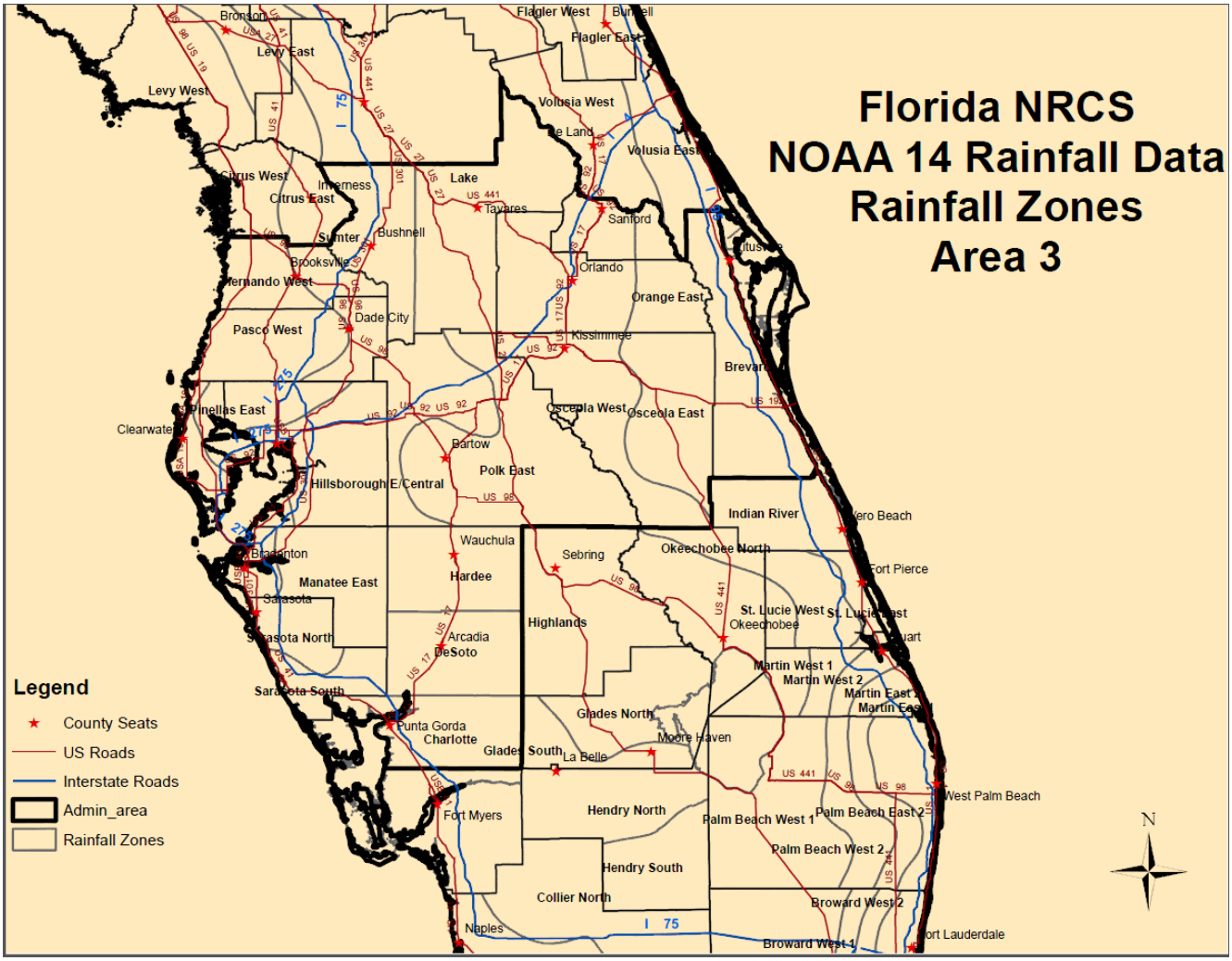
Note: This map is difficult to read. It is recommended to download the map and print to a scale that can be easily read.

Figure 12 – Florida Rainfall Zone, Area 2



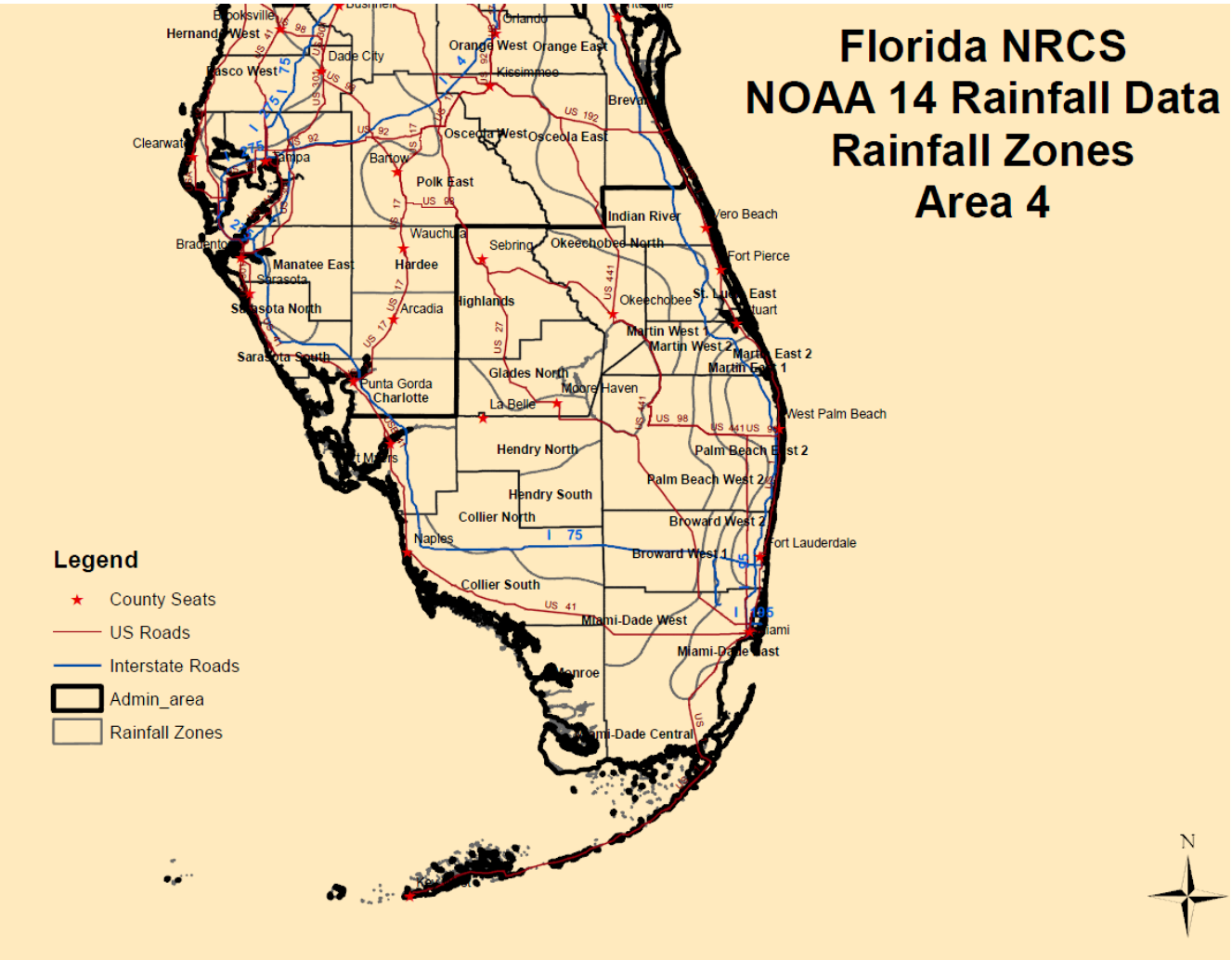
Note: This map is difficult to read. It is recommended to download the map and print to a scale that can be easily read.

Figure 13 – Florida Rainfall Zone, Area 3



Note: This map is difficult to read. It is recommended to download the map and print to a scale that can be easily read.

Figure 14 – Florida Rainfall Zones, Area 4



Note: This map is difficult to read. It is recommended to download the map and print to a scale that can be easily read.

Section III – Implementation of NOAA 14

The updated rainfall depths and distribution types will be used when estimating runoff and peak discharges described in NEH 650, Chapter 2. The design rainfall data in Table 7 replaces rainfall depths from Weather Bureau Technical Paper 40 (TP-40) and the March 1998 Florida Supplement to EFH 650, Chapter 2. The new rainfall distribution types (MSE4, MSE5, and MSE6) in Tables 1 - 6 and Figures 1 - 8 replaces the standard NRCS rainfall Types II and Type III.

This supplement will be implemented by replacing the rainfall database (**COUNTY.FL**) and rainfall distribution types (**type.rf**) used with the EFH-2 computer program. The procedure for loading the updated rainfall data (county/rainfall zone and types) is presented in Section IV. An example application of the EFH-2 Computer Program in Florida specific example is included in Section V.

Statewide GIS shapefile and KMZ files of the county/rainfall zones and rainfall distribution types have been developed. The statewide GIS shapefiles and KMZ file are located in the EFH-2 Software Updates section of the Florida FOTG site.

Section IV – Instructions for Incorporating Updated Rainfall Database and Rainfall Distribution Types into EFH-2 Computer Program in Florida

EFH-2 Runoff and Peak Discharge software requires a rainfall data (**COUNTY.FL**) and rainfall distribution types (**type.rf**). These databases are available on the EFH-2 computer program in the Updates section of the Florida Field Office Technical Guide (FOTG) site and will replace the TP40 based databases. The following describes the steps to use the updated databases with the EFH-2 computer program.

1. Navigate to and delete the TP-40 based data files titled "COUNTY.FL" and "type.rf" in the folder located at C:\Program Files (x86)\USDA\EFH2. To delete these files, the user should have administrative rights on the computer.

   Navigate to the NRCS webpage titled H & H Tools and Models at the following link: http://go.usa.gov/KoZ. Then click on WinTR-20 to go to Win TR-20 Watershed Hydrology web page. Then go to WinTR-20 Support Materials, NOAA 14 Data, and click on links for FL.

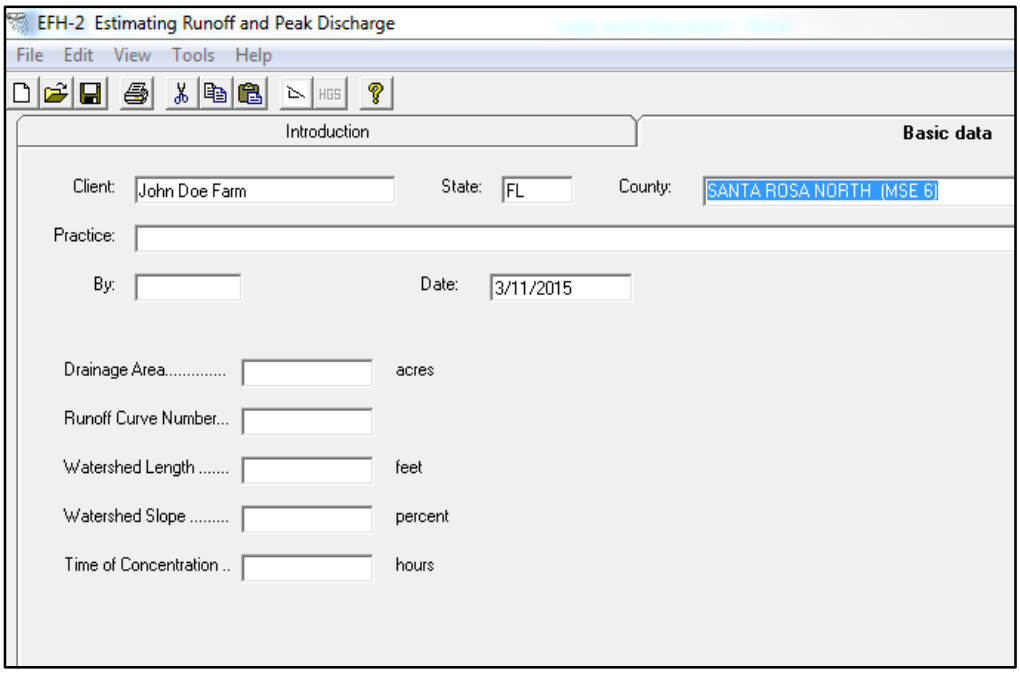
2. Unzip the file titled "NOAA_14_FL_Documentation." Individually, save the new NOAA 14 rainfall files titled "COUNTY.FL" and "type.rf" into C:\Program Files (x86)\USDA\EFH2 on your computer. To save these files, the user should have administrative rights on the computer. This will replace the existing TP40 based data file. The EFH-2 software now has the NOAA 14 rainfall depths and rainfall distribution types files for Florida.

3. Within the EFH-2 computer program, type "FL" for the state under the Basic Data tab to see every county and rainfall zone in Florida. Section V provides an example application of the Florida rainfall data in the EFH-2 computer program.

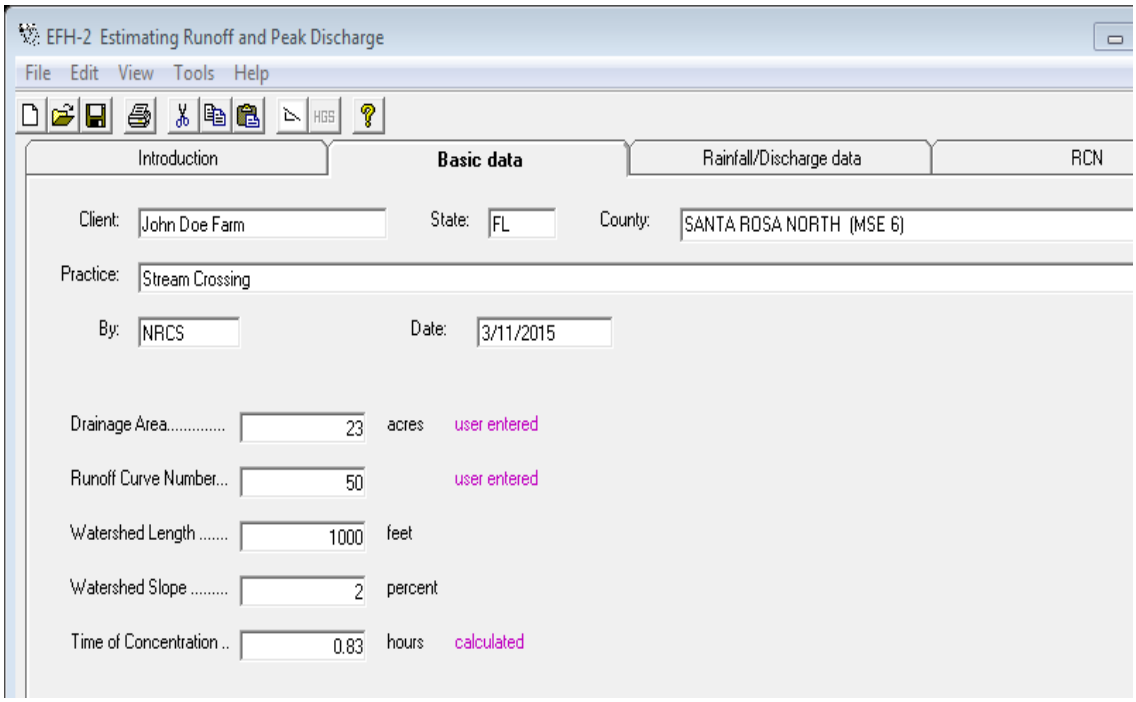
Section V – Example Application of the EFH-2 Computer Program in Florida

A small watershed in the Santa Rosa North Rainfall Zone is selected for an example. The drainage area is 23 acres, the curve number is 50, watershed length is 1,000 feet, and average watershed slope is 2 percent. From Table 7 the rainfall distribution type is "MSE 6".

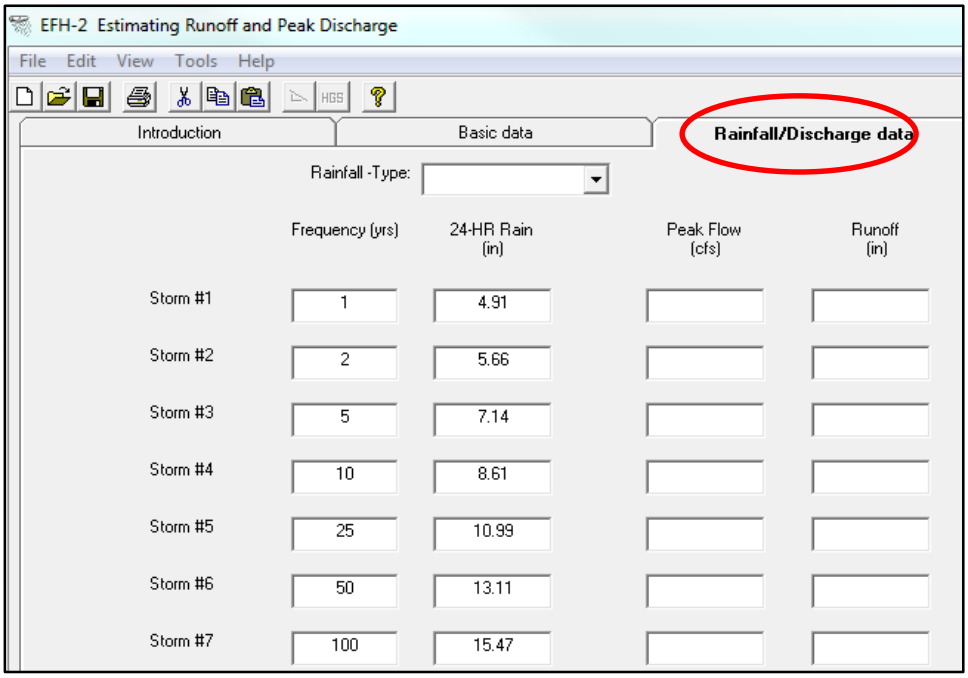
Step 1: Open the EFH-2 computer program and open the Basic Data tab. Enter State: FL and use the pull-down menu to select Santa Rosa North County. The name "MSE 6" next to the county name designates this county is in NOAA Rainfall Distribution Type MSE 6 region.

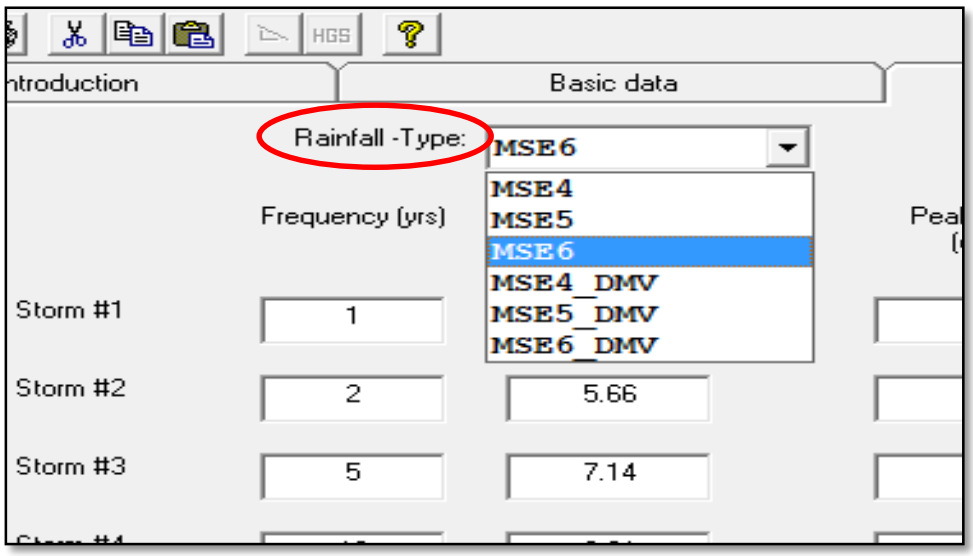


Step 2: Enter the remaining data on this window (curve number, watershed length and watershed slope). The Drainage Area and Runoff Curve Number could alternatively be entered by opening the RCN tab (far right side of Basic data window).



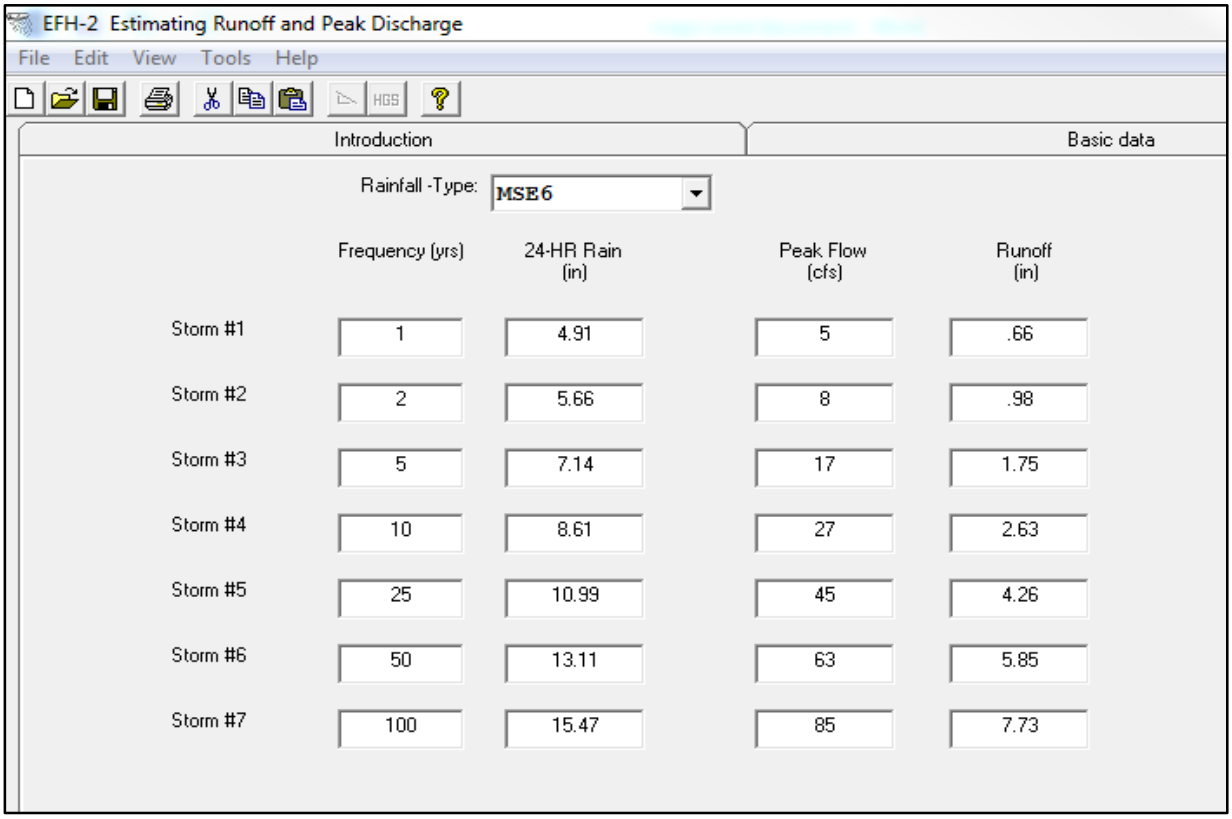
Step 3: Open the Rainfall/Discharge data tab. The 24-hour rainfall data for Santa Rosa North Rainfall Zone has automatically been entered. At this point you may replace these county values with site specific data from http://hdsc.nws.noaa.gov/hdsc/pfds/ if desired. Use the Rainfall Type pull-down menu to select MSE 6





Note: The user will need to determine if the Standard or DelMarVa Unit Hydrograph will be used in the selection of the Rainfall Type (i.e. MSE 6 or MSE 6_DMV).

Step 4: Upon choosing the rainfall type, the peak discharges and runoff depths are calculated.



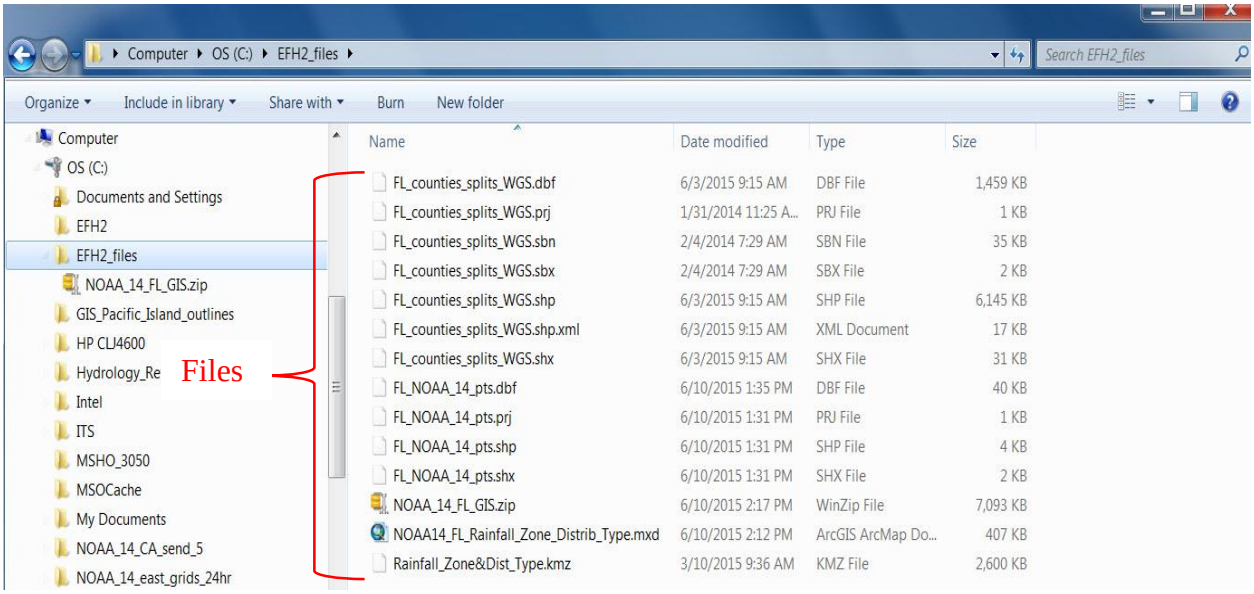
Step 5: To complete the project, click File and Save. Print output if desired. Close EFH-2.

Section VI – Use of the Shapefiles and KMZ File in ArcGIS® and Google Earth®.

There are two shapefiles titled "**FL_counties_splits_WGS.shp" and "FL_NOAA_14 pts.shp**" that can be used to locate the county/rainfall zone and distribution type for the area of interest. The procedures for importing the files (county/rainfall zone and distribution types) into ArcGIS® and Google Earth® are described below.

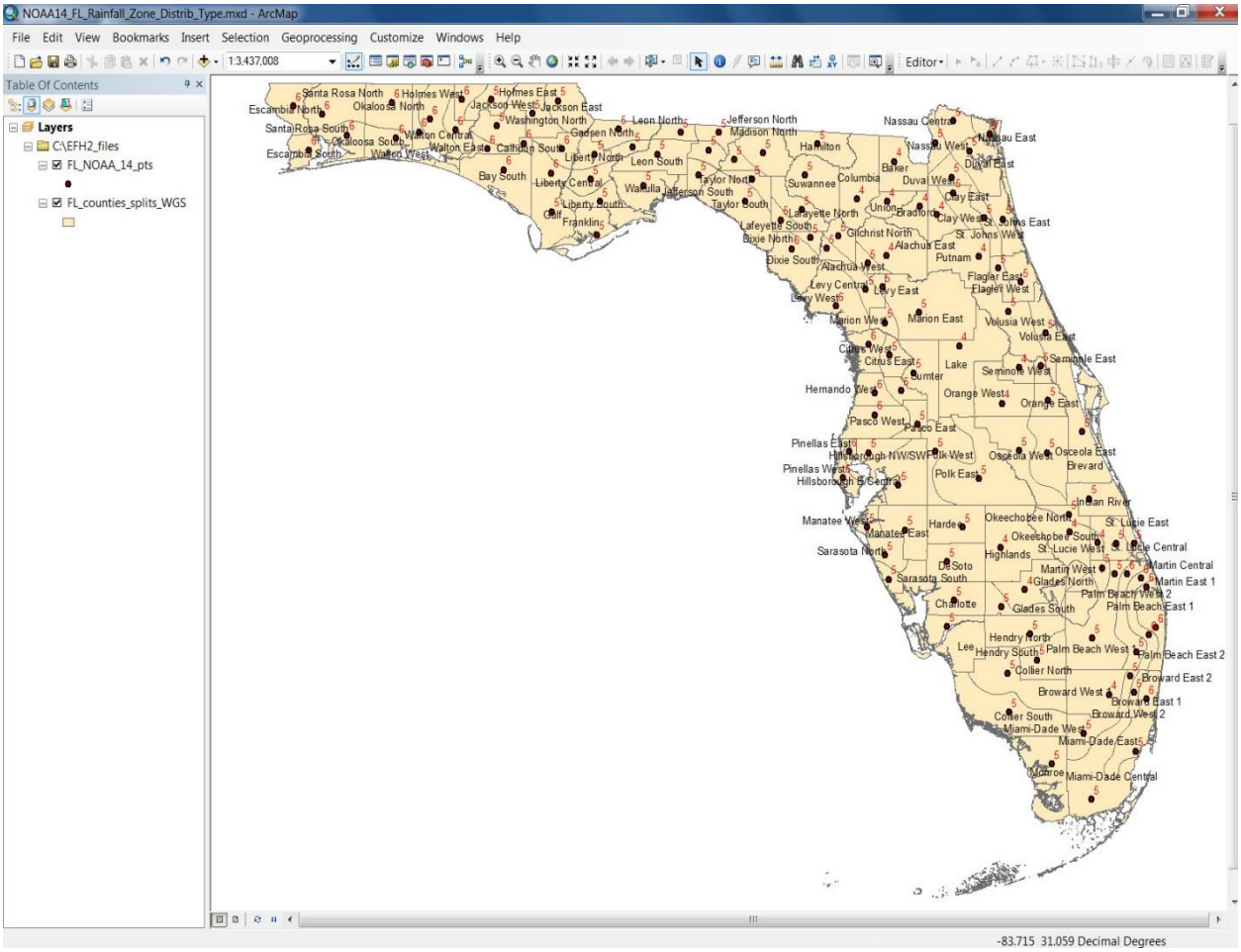
Step 1: Navigate to the NRCS webpage titled H & H Tools and Models at the following link: http://go.usa.gov/KoZ. Then click on WinTR-20 to go to Win TR-20 Watershed Hydrology web page. Then go to WinTR-20 Support Materials, NOAA 14 Data, and click on links for FL. Download the file named "NOAA_14_FL_GIS.zip" and save to your computer in your C drive in a folder called "EFH2_files." Unzip the file named "NOAA_14_FL_GIS.zip".

Exhibit 1 – Shape and ArcMap® files to be saved on computer.



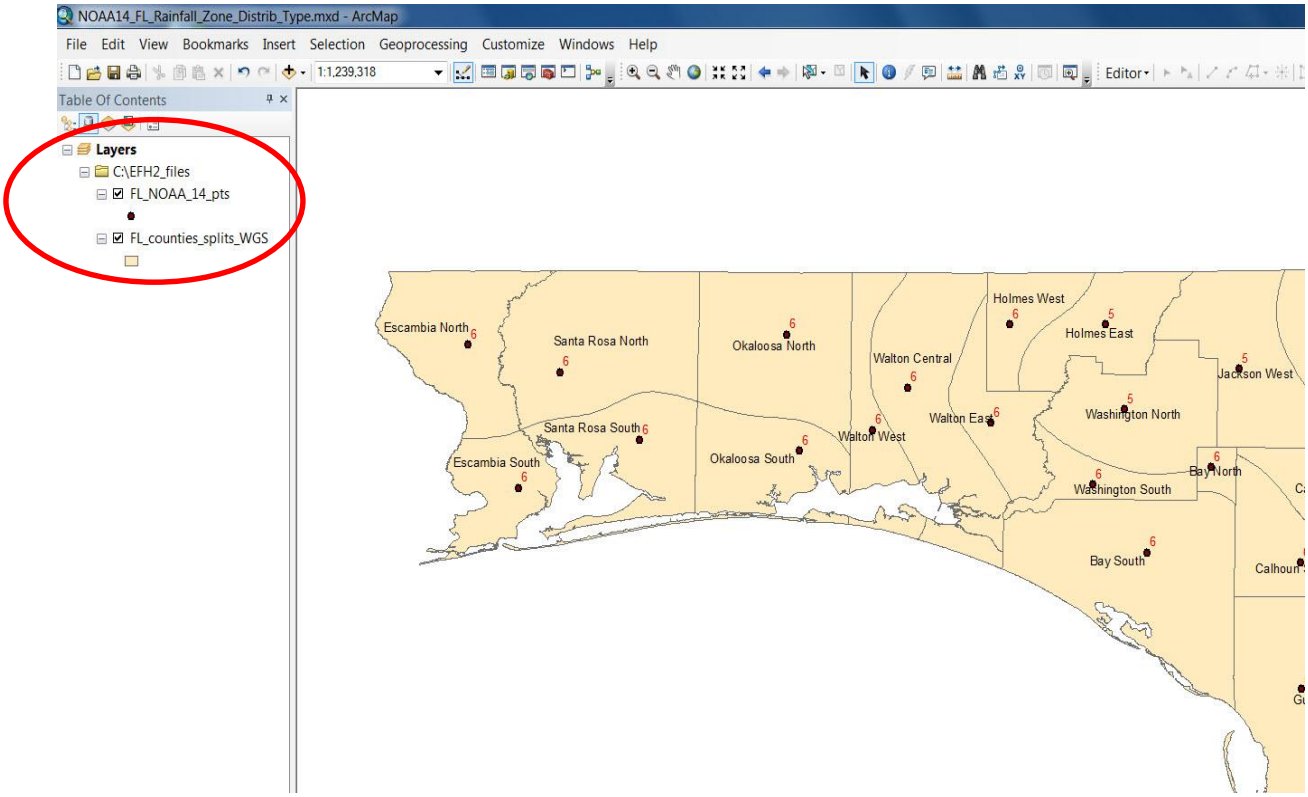
Step 2: Open the ArcMap® project file titled "NOAA14_FL_Rainfall_Zone_Distrib_Type." The screen shown in Exhibit 2 will now be displayed on your computer.

Exhibit 2 – NOAA14 Rainfall Zone and Distribution Type ArcMap® Project File.



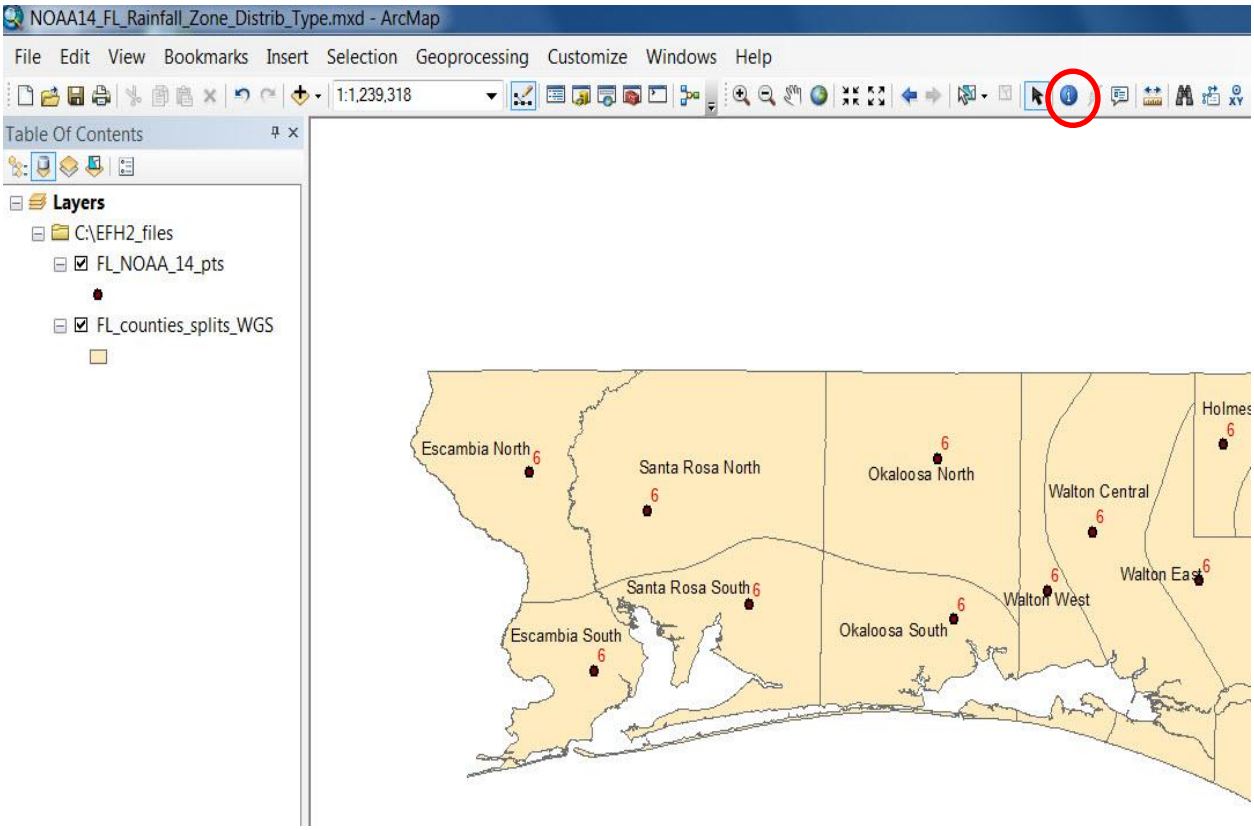
Step 3: Import in any aerials or any additional shape files (roads, project boundary, etc.) as needed to assist you in locating the area of interest.

Exhibit 3 – Additional files to upload into ArcGIS®.



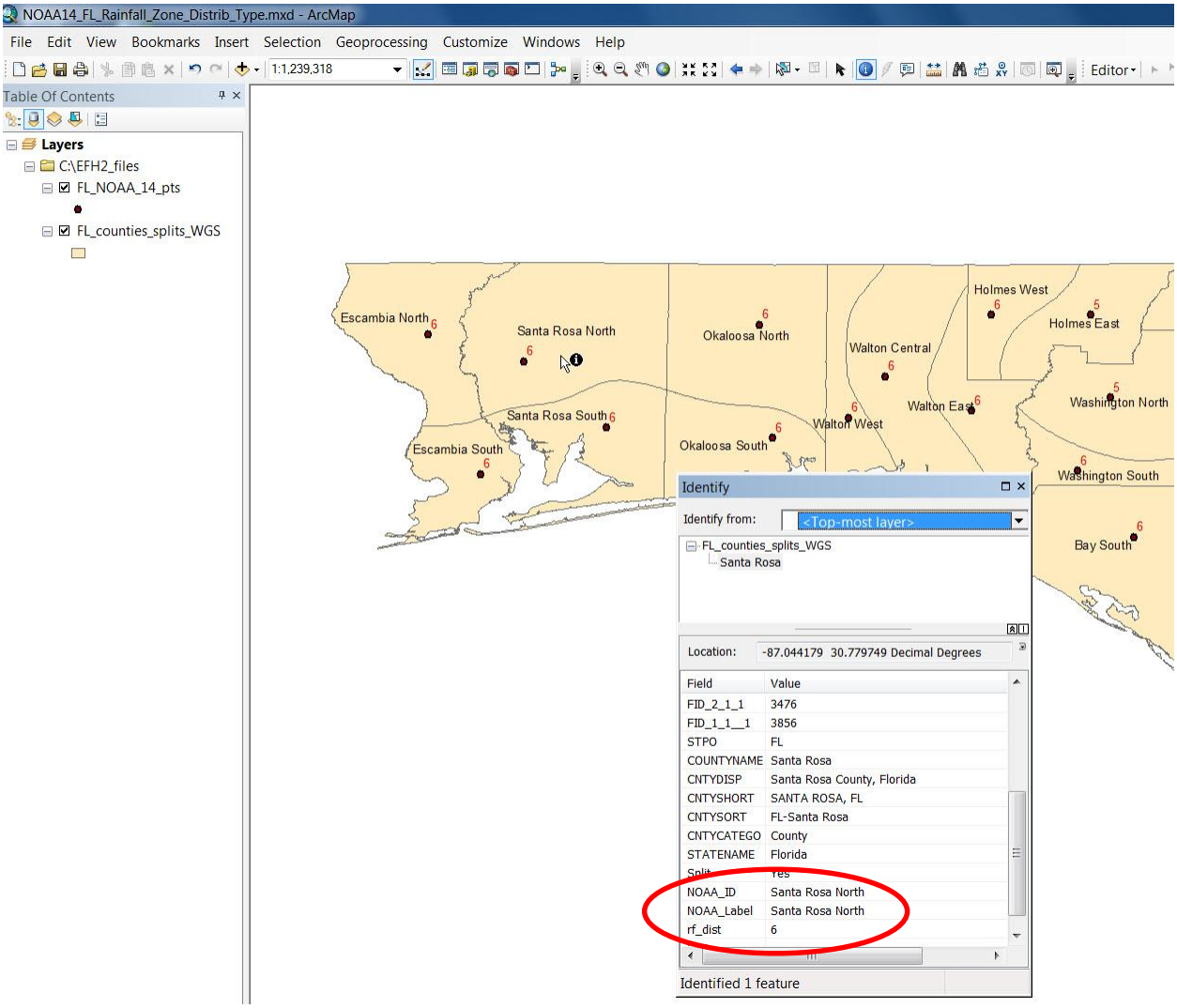
Step 4: Select the  button at the top of screen to activate the identification command in ArcGIS®.

Exhibit 4 – Activating Identification Command in ArcGIS®. Identify button is circled in red.



Step 5: Zoom in if needed and using your mouse, select the area of interest on the map. For the coastal areas, make sure to select the land area versus the adjacent waters. A window will open with the rainfall zone and distribution type displayed for that area. The example in Exhibit 5 shows that the area is in Rainfall Zone –Santa Rosa North and Distribution Type MSE 6.

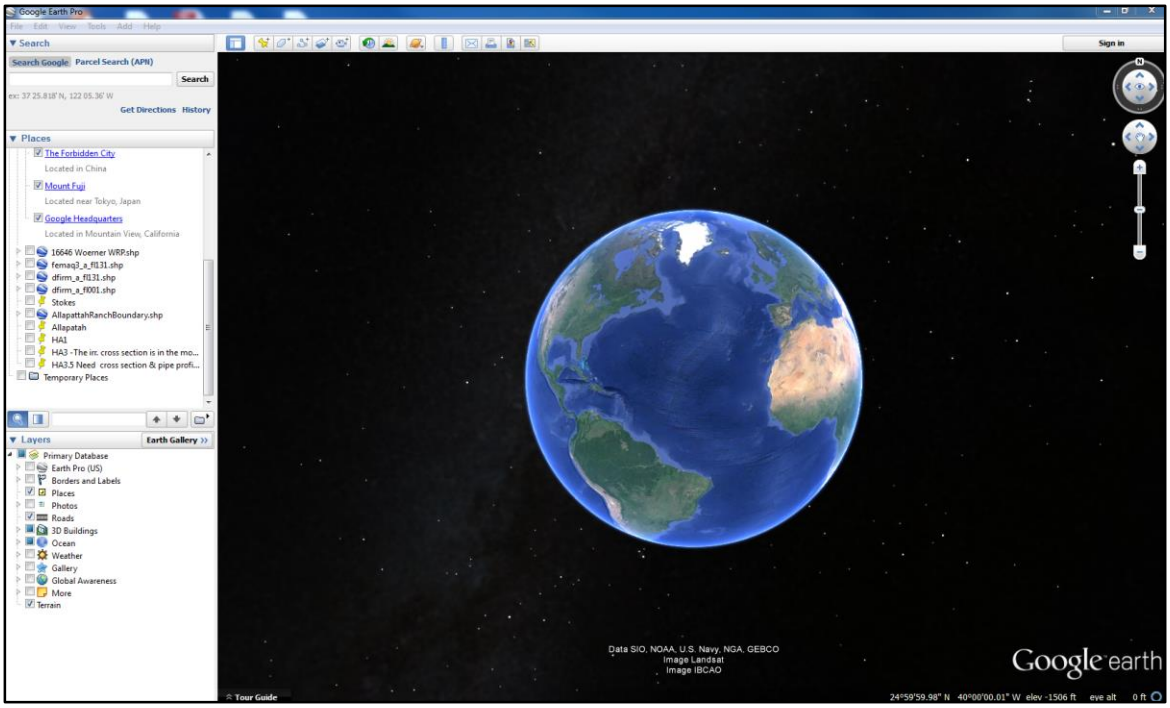
Exhibit 5 – Identifying the County/Rainfall Zone and Distribution Type.



Import KMZ files Into Google Earth®

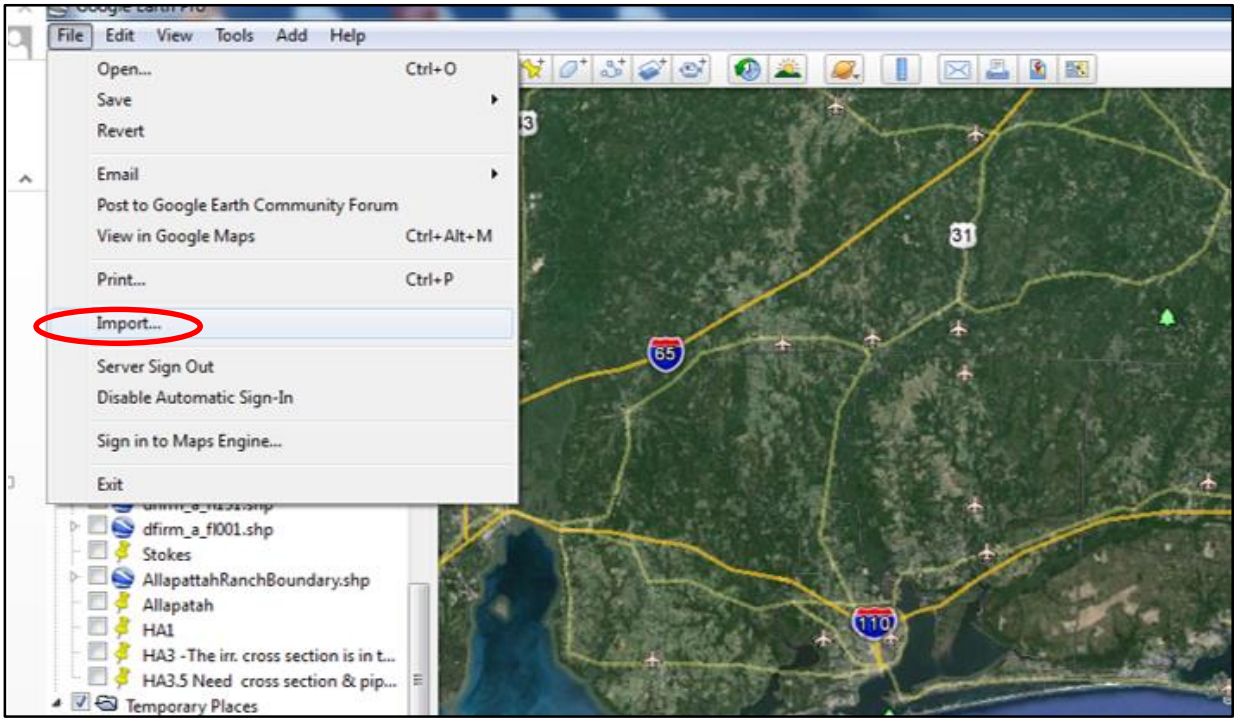
Step 1: Open Google Earth® Pro and the screen will display as shown in Exhibit 6.

Exhibit 6 – Use of Google Earth® to identify Rainfall Zone and Distribution Type.



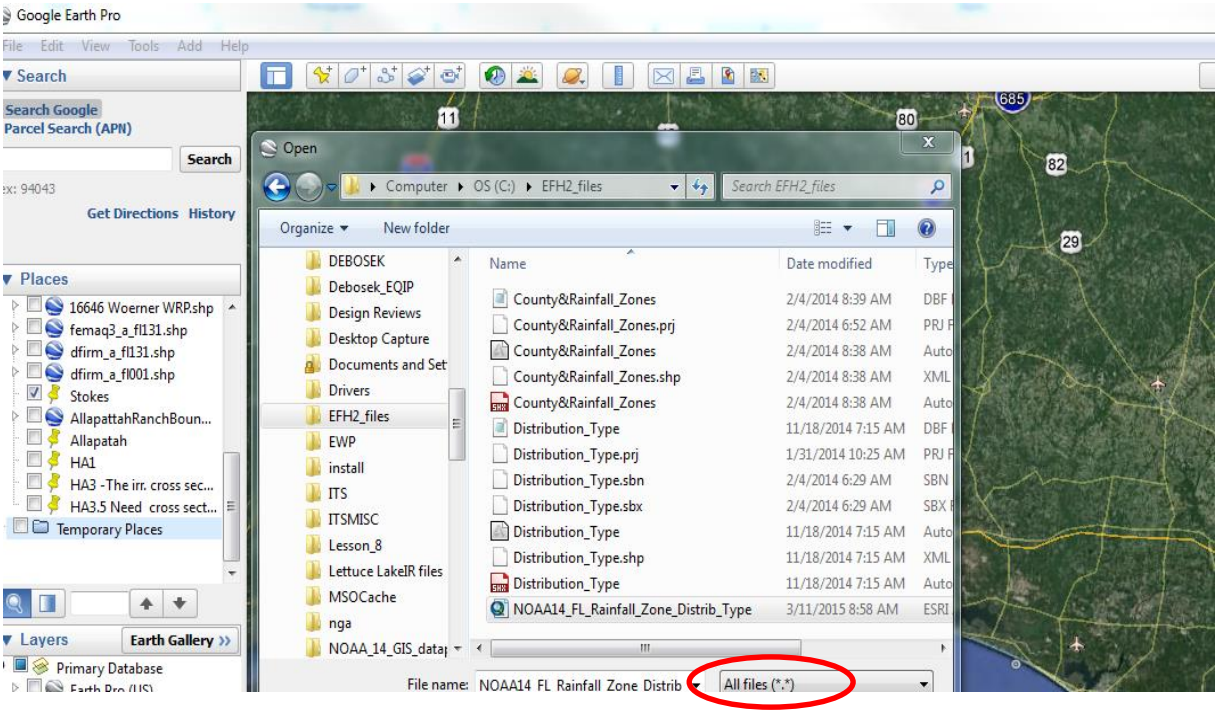
Step 2: On the "File" tab at the top of the screen, select the "Import" button.

Exhibit 7 – Import files into Google Earth®.



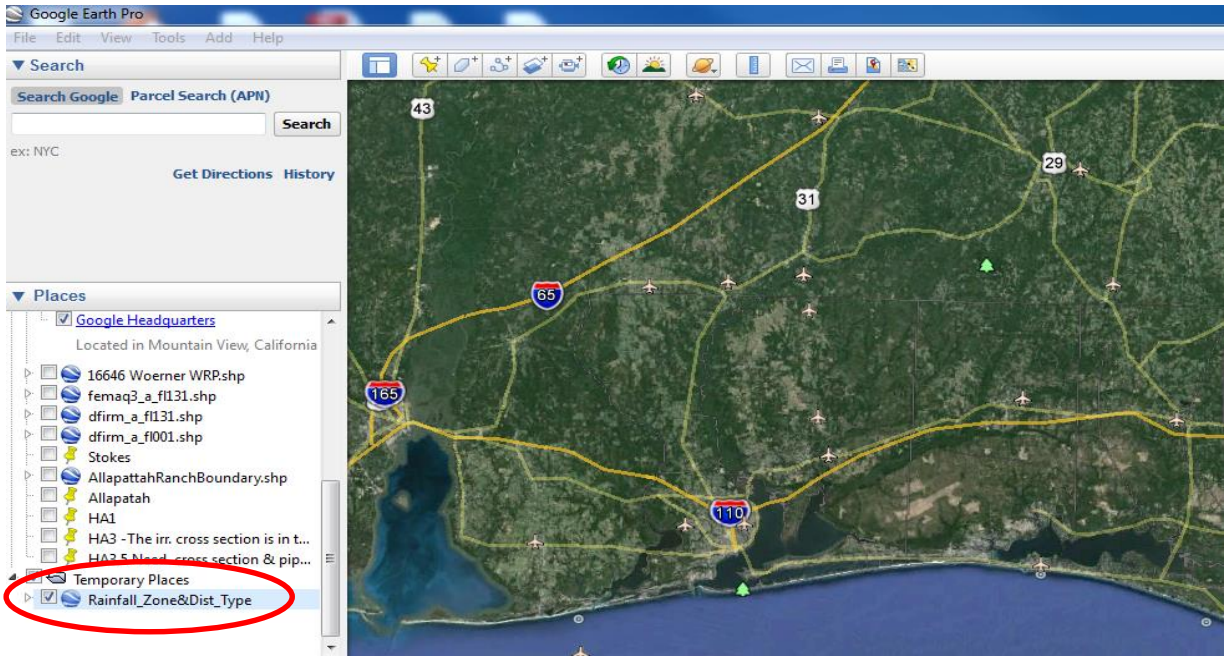
Step 3: Once you select the import button, a window will open to select the file path. Open the folder on your C drive called "EFH2_files." Select the file titled "**Rainfall_Zone&Dist_Type.kmz file."** Select "All files (*.*)" from the pull down menu and open this file.

Exhibit 8 – Import files in Google Earth®.



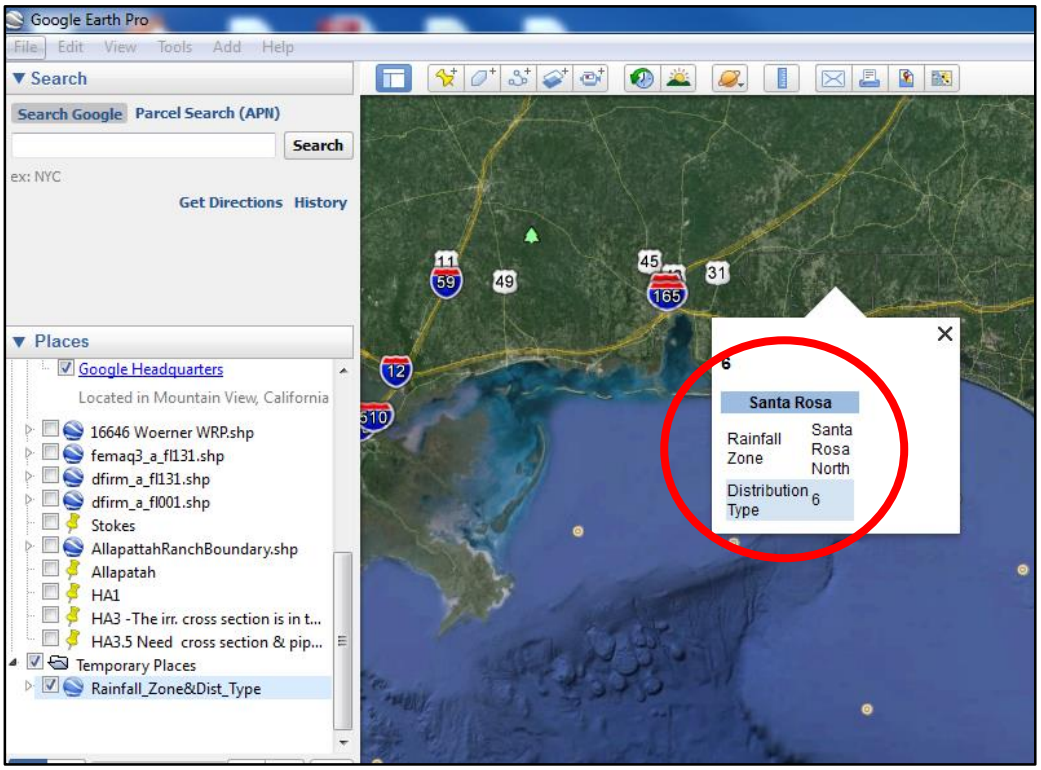
Step 4: This file will be saved on the "Temporary Places" folder of your Google Earth® session.

Exhibit 9 – Save Rainfall and Distribution Type files in Google Earth®.



Step 5: With the mouse, select the area of interest on the map. For the coastal areas, make sure to select the land area versus the adjacent waters. A window will open with the rainfall zone and distribution type displayed for that area. The example in Exhibit 10 shows that the area is in Rainfall Zone –Santa Rosa North and Distribution Type MSE 6.

Exhibit 10 – Identify Rainfall Zone and Distribution Type using Google Earth®.



NOTE: Google Earth® is copyright of Google, Inc. & ArcGIS® is copyright of ESRI, Inc.

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